DOCUMENT RESUME

ED 430 534 IR 019 558

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TITLE	An Analysis of the Status of Education Technology Availability and Usage in the Public Schools of Virginia. Report to the Commonwealth of Virginia. Second Edition.
INSTITUTION	Milken Exchange on Education Technology, Santa Monica, CA.; North Central Regional Educational Lab., Oak Brook, IL.; SRI International, Menlo Park, CA.
PUB DATE	1998-12-31
NOTE	285p.
PUB TYPE	Reports - Research (143) -- Tests/Questionnaires (160)
EDRS PRICE	MF01/PC12 Plus Postage.
DESCRIPTORS	Accountability; *Computer Uses in Education; Educational Development; Educational Environment; *Educational Technology; Elementary Secondary Education; Focus Groups; *Information Technology; Internet; Interviews; Outcomes of Education; *Public Schools; Questionnaires; School Community Relationship; School Surveys; State Surveys; Tables (Data); Teacher Competencies; Teacher Surveys; Use Studies
IDENTIFIERS	Access to Technology; Administrator Surveys; Computer Use; Conceptual Frameworks; Site Visits; *Technology Utilization; *Virginia

ABSTRACT

This study was commissioned by the Commonwealth of Virginia to assess the status of technology availability and usage in public schools in the Commonwealth. The study used the Milken Exchange's "Seven Dimensions for Gauging Progress with Learning Technology" as a framework. The first dimension focuses on new opportunities and benefits for learners through technology; the remaining six dimensions frame the essential conditions necessary to bring the effective use of technology to all learners (i.e., learning environments, professional competency, system capacity, community connections, technology capacity, and accountability). The methodology for the study included collection, analysis, and correlation of data from four sources: a survey of principals or designees representing school buildings; a survey of a statewide sample of teachers; on-site visits of school buildings representing all regions of the state; and focus groups and phone interviews of key constituents in the state. Results are discussed for each of the Seven Dimensions, and key findings and recommendations are outlined. Appendices include: survey, focus group, and site visit findings in text and tables; data by school division; and data collection instruments. (AEF)

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Report to the Commonwealth of Virginia

An Analysis of the Status of Education Technology Availability and Usage in the Public Schools of Virginia

December 31, 1998

Second Edition

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Report to the Commonwealth of Virginia

An Analysis of the Status of Education Technology Availability and Usage in the Public Schools of Virginia

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Executive Summary

At the forefront and basis of any plan should be that technology skills are not a luxury, they are life skills.

—Elementary Educator, Region 5

Nine years ago in this rural district, there was only a handful of Radio Shack TRS 80s...Now, with the assistance of state and district funding, the elementary school brought Internet access to both the school computer lab and to almost every classroom. Students begin using computers for reading instruction in kindergarten...older students exchange email correspondence with students at a school in Australia...the school leadership believes technology should be infused into all aspects of the school environment and has a strong commitment to staff development and training...For all these reasons, a small rural school in Virginia is rapidly moving into the 21st Century. The school obviously benefits from visionary leadership...

—Site Visit-Technical Report

Look before you leap. Think it through in a systemic way and follow through. DON'T PULL THE PLUG!

—Middle School Educator, Region 3,
commenting on state technology initiatives

The Commonwealth of Virginia, guided by its Six-Year Educational Technology Plan, made a significant public investment ($200 million) in school technology for 1994-1998. The spring of 1998 brought Virginia to a crossroads for education and learning technologies. Nearing the end of its Six-Year Plan, the Commonwealth halted all funding for learning technology for FY1998, while commissioning a study to "assess the status of technology availability and usage in each public school in the Commonwealth."

The Virginia General Assembly, the Governor, and the Board of Education called for an assessment of the impact of the state's investment. Their intent was to gauge the Commonwealth's progress to date with school technology and the progress Virginia has yet to make in order to intelligently and thoughtfully maximize the impact of future state investments in education technology.

These policy leaders posed questions about topics such as:

- the extent of current technology use for instruction;
- student technology-related outcomes;
- the availability of technology for instruction;
- the availability of technical support;
- the inclusion of technology in the curriculum;

- the current level of teacher preparation, including new and experienced teachers, regarding technology instruction;
- the availability of professional development opportunities;
- perceived barriers to greater technology availability and use;
- funding sufficiency for education technology; and
- the extent of support school leadership provides for technology.

In compliance with a statutory requirement, a Request for Proposal (#ETS-99) was issued in July of 1998 by the Virginia Department of Education. Through a competitive bid process, the proposal was awarded to the Milken Exchange on Education Technology, a Santa Monica, California-based foundation, and its team members: SRI International, in Menlo Park, California; and the North Central Regional Educational Laboratory, in Chicago, Illinois. The Commonwealth's award to these contractors can be attributed, in part, to the team's proposal to use the Milken Exchange's *Seven Dimensions for Gauging Progress with Learning Technology* as a framework for the study.

Dimension One focuses on new opportunities and benefits for "learners" through technology. The remaining six dimensions frame the essential conditions necessary to bring the effective use of technology to all learners.

The authors of the Seven Dimensions framework contend that simply bringing computers and the Internet into classrooms will not improve student academic performance. What is required are:

- intelligent, selective application of how and where technology can add value;
- rigor in imposing the conditions that are essential to its effective use; and
- an understanding of the powerful role it is already playing in society and in shaping the lives of our young people.

The Commonwealth's Six-Year Plan acknowledges that "infrastructure and equipment alone are not sufficient to infuse technology into instruction. Teachers must be trained, support services provided, equipment maintained, and an on-going evaluation established."

The challenge is to recognize technology's potential—then to make the hard choices and policy decisions that ensure it is responsibly and effectively used. The Seven Dimensions provides a guide for schools in making wise choices to guarantee a solid return on federal, state and local technology investments.

METHODOLOGY

The methodology for this study included collection, analysis and correlation of data from four sources: a survey of principals or designees representing school buildings; a survey of a statewide sample of teachers; on-site visits of school buildings representing all regions of the state; and focus groups and phone interviews of key constituents in the state. The instrumentation for all data sources was developed around the Seven Dimensions. Findings from the four data sources were cross-tabulated to verify results and provide insights into the data through specific examples and quotations from educators, policymakers and community members.

A survey designed to be completed by a principal or designee was sent out to all 1,885 school buildings in September of 1998. There was a response rate of 87 percent. At the same time, three to five teacher surveys were sent to a randomly selected sample of 300 schools. About 86 percent of the surveyed teachers responded. During the month of October, a team of trained researchers visited 48 school buildings, representing urban, rural and suburban elementary, middle and high schools in all eight regions of the state. Ten statewide focus groups were conducted statewide with educators, principals, community members, parents and business and industry representatives. In addition, we conducted phone interviews with key policymakers at the state level.

Data Sources:

- *Surveys from the 1,885 school buildings: 87 percent response*
- *Over 1,300 teachers surveyed: 86 percent response rate*
- *Site visits in 48 school buildings, in all regions, representing urban, rural and suburban schools*
- *Ten focus groups and interviews with key state policymakers*

FINDINGS AND RECOMMENDATIONS

The triangulation of data from the surveys, site visits and focus groups (see Section 5 of this report) resulted in the following findings across the Seven Dimensions.

1. Technology Capacity and Community Connections

The researchers collected and analyzed data regarding technology capacity in Virginia schools, asking the question, "Are there adequate technologies, networks, electronic resources and support to meet the education system's learning goals?"

They also investigated whether school-community partnerships that promote equitable access for all students are being formed around the technology.

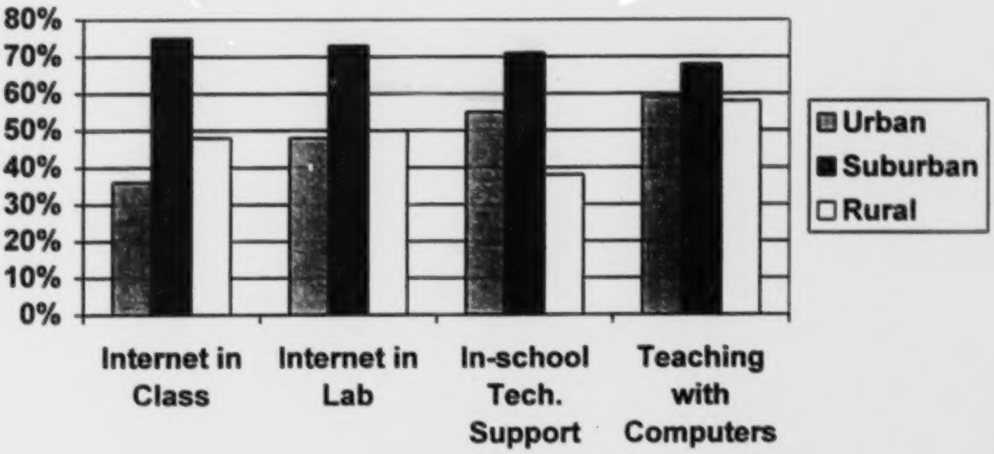
Finding #1
While the Commonwealth's investments in education technology are evident in schools, the level of technology access is not yet adequate to meet the education system's learning goals. In addition, there are significant disparities in student access across school divisions and among schools within divisions.

- The data from this study indicates a student-to-multimedia computer ratio of 10.9 to 1, slightly lower than the national statistic of 12:1 cited by *Education Week* in Technology Counts '98 (Source: *Market Data Retrieval*).

Type of Computer	Mean Number of Students per Computer			
	Computer Lab	Class	Media Center	All School Areas
Modern Computer (PC—486 or better or Mac—LCIII or better)	20.1	13.8	68.8	12.5
Multimedia Computer	30.3	20.2	105.4	10.9
Computer connected to a Local Area Network	29.0	20.4	96.9	10.7
Computer connected to the Internet by modem or high speed line	30.0	19.1	56.2	9.7
Total of all instructional computers	15.2	10.0	55.3	5.4

- The data from this audit's surveys support national statistics indicating that approximately 60 percent of Virginia's classrooms have at least one computer connected to the Internet. Unfortunately that percentage ranges from zero in some school divisions to 100 percent in others, with suburban schools averaging 75 percent of classrooms wired while rural schools report 46 percent and urban schools 36 percent. Researchers conducting site visits reported that for some schools, the state technology funds are literally 100 percent of the technology funds available to that district, while at other schools the state funds constitute barely 10 percent of the total the district was investing in learning technology. Technology access and quality of experience varies dramatically between students depending on where they attend school in Virginia.

Differences between Urban, Suburban, and Rural Schools on Availability and Use of Technology for Learning and Teaching



- Another key issue is the level of technical support, with 47 percent of principals citing this as a significant barrier to the effective use of technology.

Recommendations Addressing Finding #1: To realize a full return on the initial investment in infrastructure, the Commonwealth should consider the following:

1a. "Staying the course," continuing to invest funds in the technology infrastructure to assure all students adequate access to technology.

- Continuing to provide funding from state bonds for technologies, networks and connectivity;
- Establishing affordable, high-speed access to electronic resources for all schools and school divisions (e.g., state-supported backbone, aggregated purchasing for connectivity services);
- Establishing technical assistance models and technical support systems for school divisions and school buildings;
- Updating and disseminating technology guidelines or standards related to networking, facilities and connectivity.

1b. Instituting a funding formula that assures equity.

- Studying the equity issue and revising the funding formulas for learning technology from state and federal dollars, in order to achieve equity;
- Allowing schools to allocate state and federal funds to establish extended hours for community access to school labs and provide technology access for students in community centers and public libraries.

2. Learners and Learning Environments

Researchers investigated the impact on learners and classroom environments from the educators' perspective, asking, "Are learners in Virginia's public schools using the technology in ways that deepen their understanding of academic content and, at the same time, advance their knowledge of the world around them?"

Another key research question was: "Is the learning environment designed to achieve high academic performance by students through the effective use of technology?"

Finding #2
The Commonwealth's K-12 students and educators are gaining expertise in basic computer skills but generally are not yet using technology effectively to improve student learning.

A teacher in Region 3 stated, "I don't think we're integrating technology into instruction. We're using it more as remediation or independent learning." Virginia's investment in learning technologies has launched schools into a complex innovation cycle. Innovations often start off slow, build toward rapid change and then level off as the practice becomes prevalent. All data suggest that such innovation is in the very beginning stages in Virginia. Without more leadership and vision, the return on the Commonwealth's initial investment in hardware and connectivity will never be fully realized.

Both the survey and the site-visit data suggest that the majority of the time teachers spend with computers is in preparation for lessons (word processing or doing research on the Internet), followed by instructing students, checking or recording student scores, and communicating with colleagues. The consensus among teachers and administrators in the focus groups was that students can benefit from the proper use of technology, especially in terms of problem-solving, organization, research skills and taking responsibility for their own learning. *Most participants, however, do not believe that they are there yet.*

Recommendations addressing Finding #2: Virginia is in the excellent position of having contemporary technology and Internet connectivity available to some degree in most classrooms in the state. However, as the Virginia Six-Year Plan clearly states, the schools need more than boxes and wires. Educators need innovative, educationally sound models and approaches to teaching and learning with technology that enable students to excel at academic challenges.

To accomplish this, the Commonwealth should consider:

2a. Providing proactive state leadership.

- Broadening the vision of learning technology;

- Translating that vision into common classroom practice with the help of state-supported models and prototypes; and providing information on research and effective practice.

2b. Translating the state vision for technology into classroom practice in all academic content areas.

- Establishing state initiatives that include provision of the "essential conditions" necessary to engage educators and their students in effective uses of technology in schools (equipment, software, connectivity, teacher and student training, curriculum and lesson plan development, new designs for learning, new roles for students, ties to learning goals, appropriate assessments).

2c. Linking the state's future investments to effective practice.

- Establishing criteria for technology funding to schools that provides incentives for such funds to be used in ways that lead to higher student performance in intellectually challenging work across the content areas;

- Establishing support systems for educators in key areas, including technical support, as well as support for changing curriculum and instruction to make best use of technology.

3. Funding, Systems Thinking and Professional Competency

Knowing that certain essential conditions are necessary for teachers to use technology effectively, the researchers investigated the question, "Is the education system reengineering itself to systematically meet the needs of learners in this knowledge-based, global society, including the realignment of funding priorities?"

They also analyzed evidence to answer the question, "Are educators fluent with technology and do they effectively use technology to the learning advantage of students?"

Finding #3
The Commonwealth lacks many of the essential conditions necessary for effective use of technology in schools. These are: support for proactive, visionary leadership; high-quality, content-based professional development; access to model content-based projects; links to educational reform; links between technology and school improvement plans; technical assistance for schools; and general revenue streams that allow district flexibility in supporting these essential conditions.

Site visits and focus groups strongly indicate that most Virginia educators are not aware of the state's vision for technology in schools. While many teachers are interested in using technology to create the conditions under which their students will excel, they don't understand how to translate the state's vision into classroom practice, nor do they have the requisite technologies and instructional materials to do so. It also seems they have little opportunity to improve their ability to use technology effectively. While the state has adopted teacher standards for technology, assessment is left to individual school divisions and varies widely across those divisions. Professional development to meet those competencies is not handled systematically at the state or local level.

Only one in five teachers rated themselves as "advanced" in using computers for instructional applications. The study found that student motivation through technology usually correlated with the teacher's comfort with using technology, ready access to technology in the classrooms, and adequate support within buildings and by school divisions.

It takes more than a dedicated, committed teacher to bring about effective use of technology for learning. It takes leadership and change from the statehouse to the schoolhouse. *Such systemic change has yet to happen in the Commonwealth.*

Recommendations addressing Finding #3: Incorporating technology into schools in ways that enrich and improve student learning is a complex undertaking and will require systems thinking and change-management across all levels of the education system.

The Commonwealth should consider:

3a. Providing quality opportunities for educators to meet and exceed high standards for learning technology set by the state.

- Maintaining high standards for technology competencies for pre-service teachers and administrators and the means to achieve such standards;

- Maintaining high standards for technology competencies for practicing teachers and administrators; and creating state support systems for their professional growth that directly link to improved student learning (learning technology centers, professional development models, statewide prototypes).

3b. Requiring systems thinking throughout the state and building technology/school improvement plans that focus on learning.

- Systematically updating, funding, implementing and assessing the state's Six-Year Technology Plan. Parallel school-division technology planning should be supported and a requirement to access state technology funds;

- Supporting statewide purchasing of hardware, software and online services to aggregate buying power and ensure that all schools have access to content through state-provisioned infrastructure.

3c. Establishing an ongoing, stable revenue stream to support the essential conditions necessary for school divisions to ensure equitable, quality educational opportunities for all students. Such funding should be in addition to maintaining funding for technology infrastructure from state bonds and should be equitably distributed to school divisions.

4. Accountability and System Capacity

The Six-Year Plan in Virginia calls for ongoing evaluation of impact. Researchers investigated the questions, "Is there agreement on what success with technology looks like? Are measures in place to focus on the vision, track progress and report results?"

Finding #4

Technology use in Virginia schools focuses primarily on skill development rather than advancing student learning across the core Standards of Learning.

Virginia's focus on separate SOLs for technology translates into teacher practices that focus more on developing students' basic technology skills than integrating technology across the curriculum. With the increasing emphasis on student scores on state SOLs, teachers seem unclear as to technology's role in supporting core SOLs. Because of the expectation that students should meet and exceed technology SOLs at the 5th- and 8th-grade levels, teachers focus on technical skills rather than applications in content areas. As one principal noted, "While the SOLs represent high minimum standards, they are not a vision for the future."

Note: The Virginia Department of Education reported passing scores in 1998 for Technology Standards of Learning at the 5th-grade (72 percent) and 8th-grade levels (63 percent). Virginia educators commented in the focus groups about the inadequacy of paper and pencil tests for assessing technology knowledge, skill and ability.

Recommendations addressing Finding #4

The Commonwealth should consider:

4a. Promoting the use of technology to support and give relevance to the current academic SOLs in the near-term.

- Designing strategies to use technology in improving instruction and supporting student achievement across the SOLs;

- Designing, prototyping and implementing reliable and credible assessments of students' abilities to apply technologies, solve problems and improve learning across the academic SOLs.

4b. Ensuring that state learning goals reflect the digital information age.

- Reviewing and revising the Standards of Learning to reflect technology and the knowledge-based society, especially as schools become more technologically savvy;

- Designing new measures to assess the technology-enriched academic standards.

Students in the 21st century will need schools with 21st century learning goals. Science and mathematics (bio-genetics, space travel, simulations, modeling, etc.), language arts and communication (visual images, email, the Internet, word processing, desktop layout and design, digital photography and editing, etc.) and social studies (politics, global economies, transportation, trade, global manufacturing, virtual companies, FDA regulations, etc.) have all been transformed by emerging technologies. Virginia's SOLs need to reflect these significant societal changes.

Barriers

The common barriers to increased use of computers in classrooms, as mentioned in the *site visits* conducted in October of 1998 are:

- Inadequate quantity and/or quality of equipment and software;

- Lack of adequate and timely technical assistance;

- Inadequate time for teachers to identify, learn and practice using the appropriate applications;

- Difficulty in accessing computers within schools;

- Network failures (often chronic);

- Inadequate access to the Internet;

- Too little professional development focusing on integrating technology into the curriculum.

The overall consensus in focus groups was that educators need time to learn how to integrate technology across academic areas. They need to understand how and where to use technology, become computer literate, and explore and develop a learning environment which integrates technology in meaningful ways before it can be held accountable for student technology outcomes.

> Focus group discussions revealed a critical need for professional development focusing on integrating technology into the curriculum. Participants felt a lack of the manpower needed to create an "ideal" technology learning environment. Focus group participants concluded that while technology might be available in the schools and classrooms, lack of understanding about how to manage and use technology keeps it from being integrated into daily instruction and learning. While the Virginia Standards of Learning (SOLs) are a core part of the learning context in the schools, educators are struggling with how to use technology effectively in teaching them.

Conclusions

This *Analysis of the Status of Education Technology Availability and Usage in the Public Schools of Virginia* strongly suggests that the Commonwealth's vision is not being reached in most public schools. Of the Seven Dimensions necessary for sustained growth in the effective use of technology in schools, the Commonwealth is making significant progress on only one of them, Technology Capacity. The voices from the Commonwealth's public schools represented in this study by survey, site-visit and focus-group data suggest that if the other dimensions are not addressed promptly, the Commonwealth will not see the full return on its investment in technology capacity. The educators seem ready to use the technology they have for more significant purposes, but to do so they will need vision, leadership, support, prototypes and resources from the state to accompany the state and local investment in equipment, networking and connectivity.

The challenge is that of recognizing technology's potential—which the Commonwealth of Virginia has done, then making hard choices and policy decisions to ensure it is responsibly and effectively used.

Background

The Internet is growing faster than all other technologies that preceded it:

- Radio existed for 38 years before it had 50 million listeners;
- Television took 13 years to reach 50 million viewers;
- The World Wide Web took only four years to attract 50 million users;

Source: "The Emerging Digital Economy," US Department of Commerce, 1998

The digital communication age is here. The U.S. economy today is strong because of information technology industries. In the last four years, information technology—which makes up only ten percent of the total gross domestic product—accounted for a staggering 37 percent of economic growth.

The future belongs to the educated—provided their education includes knowledge about technology. Technology's reach extends into virtually every facet of society:

- agriculture—farmers fertilizing fields via tractors with computers on board that regulate the distribution of nutrients based on soil and yield data, informed through Global Positioning Systems (GPS);
- manufacturing—factories completely automated through robotics;
- the sciences—DNA mapping, laser surgery, magnetic resonance imaging;
- service industries—the dispatching of taxi drivers based on GPS location tracking; Federal Express packages electronically tracked from pickup/entry to delivery by drivers equipped with Personal Digital Assistants;
- communication—pagers, cell phones, faxes, digital assistants, video phones.

Today Microsoft, Intel, Compaq, Dell and Cisco are household names and have seen their aggregate market value increase from $10 billion to over $550 billion in just ten years.

Virginia educators are well aware of these realities, as evidenced by the following recommendation to the state from focus group participants involved in this study:

Always have at the forefront and basis of any plan that technology is not a luxury skill but a life skill. Each student leaving school—from McDonald's worker to mechanic, from doctor to secretary—will need to be proficient with technology.

The U.S. economy today is strong because of information technology industries.

The question is not "if" technology belongs in today's schools...

The real question is whether or not the American education system is using technology effectively.

TECHNOLOGY AND EDUCATION

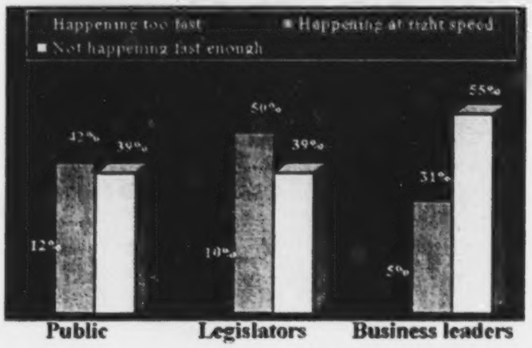
This infusion of technology across society brings challenges and opportunities to education. The question is not *if* technology belongs in schools. Today's students don't know a time without space travel, pagers, cell phones and the Internet. The real question is whether or not the American education system can evolve into one that uses technology effectively to bring added value and relevance to children's learning experiences and academic performance.

According to a national public opinion poll commissioned through the Milken Exchange in June of 1998 and conducted by Peter Hart Research Associates, "The American electorate is strongly committed to making certain that the nation's public schools are properly equipped with computers and technology and is dissatisfied with the slow pace of current efforts of their state government to make the necessary investments."

◆

"The American electorate...
is dissatisfied with the slow pace of current efforts of their state government to make the necessary investments."

Introduction Of Computers/ Technology Into Classroom

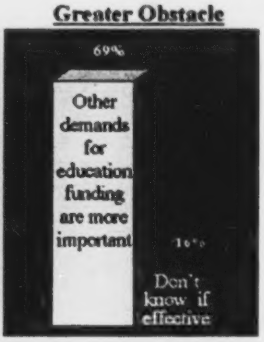


Legislators' Reluctance To Fund Technology In Education

Volunteered Reasons

Legislators don't understand, are computer illiterate	16%
Not enough $ to go around	14%
Money going to more important things	9%
Money doesn't go where it's intended to go	8%
Spend too much on schools	7%
Money for teacher salaries	7%

Greater Obstacle



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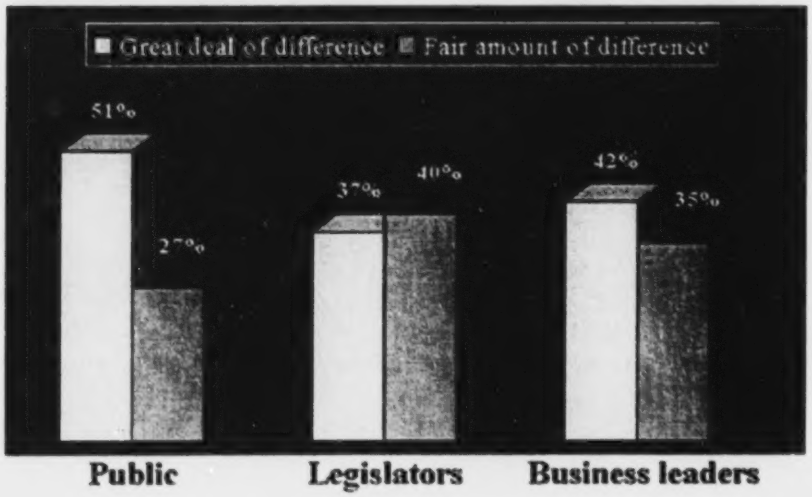
The public is convinced that technology can be a powerful, effective learning tool—but only in the right hands and under the right conditions. Under the right circumstances, technology has been shown to:

- accelerate, enrich and deepen student understanding of basic skills;
- promote critical thinking, problem solving and team learning;
- motivate and engage students by bringing relevance and real-world applications to academics;
- increase the economic viability of tomorrow's workforce;
- strengthen teaching and learning;
- promote positive change in schools and school systems; and
- connect students and teachers to rich learning resources beyond the classroom.

Business leaders voice the strongest support for investments in learning technology, based on the belief that the increased use of computers and technology in classrooms will improve the quality of their workforce.

Source: Public opinion poll commissioned through the Milken Exchange
by Peter Hart Research Associates.

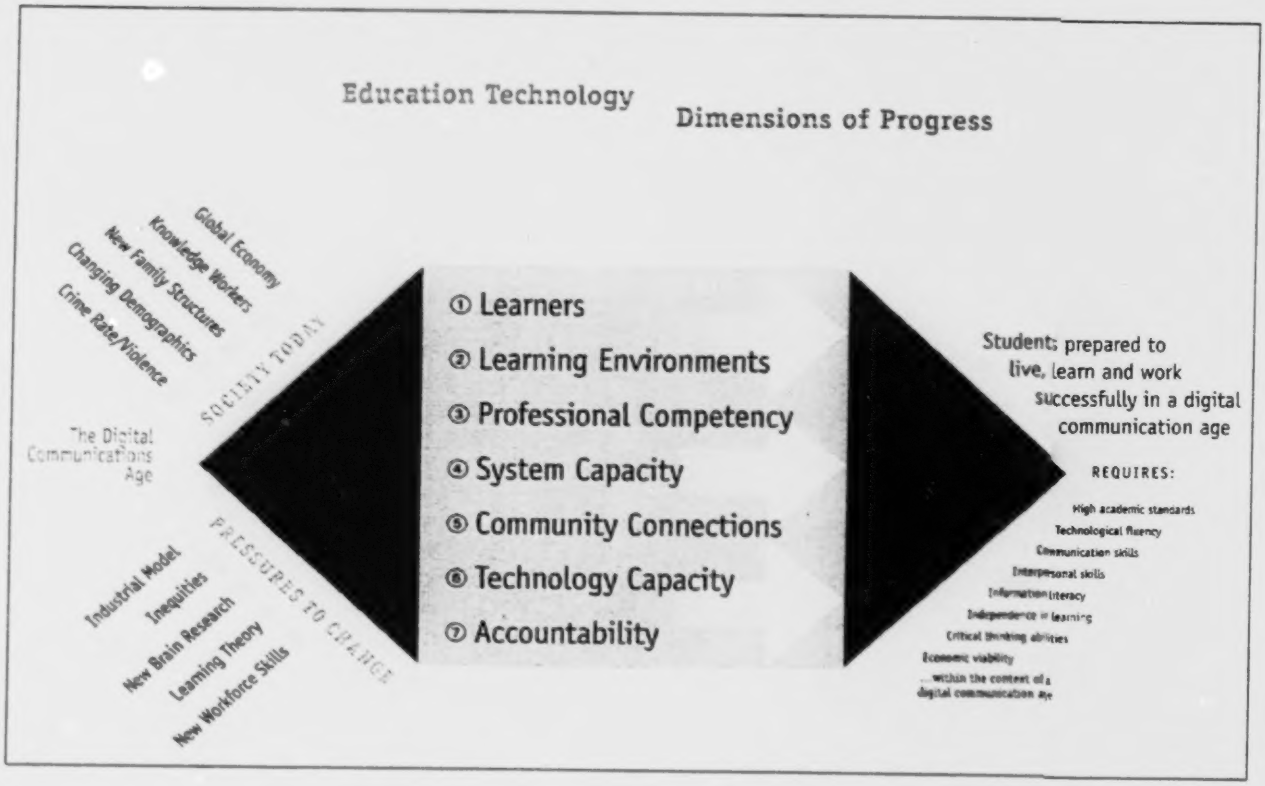
Difference Computers Would Make In Quality Of Education



THE SEVEN DIMENSIONS FOR GAUGING PROGRESS: THE RIGHT QUESTIONS

The Milken Exchange recently published a framework for ensuring that schools make wise choices to guarantee a solid return on federal, state and local technology investments, entitled *Technology in American Schools: Seven Dimensions for Gauging Progress.*

This audit on technology in Virginia schools was conducted through the Seven Dimensions framework.



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The educational community, technology coordinators, policymakers and researchers across the country are using this framework to address questions such as:

LEARNERS:

Are learners using the technology in ways that deepen their understanding of the content in the academics standards and, at the same time, advance their knowledge of the world around them?

LEARNING ENVIRONMENT:

Is the learning environment designed to achieve high academic performance by students through the alignment of standards, research-proven learning practices and contemporary technologies?

PROFESSIONAL COMPETENCY:

Is the educator fluent with technology and does he/she effectively use technology to the learning advantage of his/her students?

SYSTEM CAPACITY:

Is the education system reengineering itself to systematically meet the needs of learners in this knowledge-based, global society?

COMMUNITY SUPPORT:

Is the school-community relationship one of trust and respect, and is this translating into mutually beneficial, sustainable partnerships in the area of learning technology?

TECHNOLOGY CAPACITY:

Are there adequate technologies, networks, electronic resources and support to meet the education system's learning goals?

ACCOUNTABILITY:

Is there agreement on what success with technology looks like? Are there measures in place to track progress and report results?

Introduction to the Study

CONTENT/PURPOSE OF STUDY

The Commonwealth of Virginia, guided by its Six-Year Educational Technology Plan for Virginia (1996-2002), has made a significant public investment in school technology. The year 1998 brings Virginia to a crossroads for education and learning technologies. In accordance with the Six-Year Plan, the Commonwealth has called for a study to "assess the status of technology availability and usage in each public school in the Commonwealth."

In compliance with a statutory requirement, the Virginia Department of Education issued a Request for Proposal (#ETS-99) in July of 1998 for the aforementioned study. Through a competitive bid process, the proposal was awarded to the Milken Exchange on Education Technology, located in Santa Monica, California, and its team members: SRI International, located in Menlo Park, California; and the North Central Regional Educational Laboratory in Chicago, Illinois.

The Commonwealth has called for a study to "assess the status of technology availability and usage in each public school in the Commonwealth."

METHODOLOGY

The methodology for this study includes the correlation of data from four sources: a survey of principals or designees representing school buildings; a survey of a statewide sample of teachers; on-site visits of school buildings representing all regions of the state; and focus groups and phone interviews of key constituents in the state. The instrumentation for all data sources was developed around the Seven Dimensions and cross-tabulated to verify results and provide insights into the data through specific examples and quotations from educators, policymakers and community members.

A survey designed to be completed by a principal or designee was sent out to all 1,885 school buildings in September of 1998, with a response rate of 87 percent. At the same time, three to five teacher surveys were sent to a randomly selected sample of 300 schools. Eighty-six percent of the teachers surveyed responded. During the month of October, a team of trained researchers visited 48 school buildings, representing urban, rural and suburban elementary, middle and high schools in all eight regions of the state. Ten focus groups were conducted with educators, principals, community members, parents and business and industry representatives statewide. In addition, phone interviews were conducted with key policymakers at the state level.

The data from these sources were then synthesized into a general report on each of the Seven Dimensions (see Section 5). Findings and recommendations across these dimensions are found in Section 4 of this report.

KEY FINDINGS ON THE STATUS OF EDUCATION TECHNOLOGY IN THE COMMONWEALTH

FINDING #1:

While Virginia's investments in education technology are evident in schools, the level of technology access is not yet adequate and there are significant disparities in student access across school divisions and among schools within divisions.

Q: What defines "adequacy" for technology access in today's classroom?

- Nationally, most parents, business leaders and educators would agree that a "modern" classroom would include technology and Internet access. While the technology equipment, software and Internet services must align with the academic subject of the classroom, a common rule of thumb for the "ideal" classroom is: a ratio of four to five students-per-multimedia computer; Internet access through those same computers; a projection device for a classroom multimedia, Internet-connected computer; building access to other technologies such as digital cameras, scanners, and probes for science classrooms; teacher access to technology for productivity, administration and instruction; classroom access to video; classroom access to phones; technical support for the building, etc.

Voices of Virginia's educators: The Technology Ideal...

> *According to focus group participants, the "technology ideal" would include classrooms with pods of computers (five to 10), projection and peripheral equipment such as scanners and printers, Internet access, and related software.*
>
> *Teachers would have access to laptops. Depending on the size of the school, between 1 and 3 full-time support personnel would be available to help integrate technology, troubleshoot and maintain the technology, and maintain the LAN and WAN networks.*
>
> *When asked how their schools rate regarding this goal on a scale of one to ten, six participants said they were on the low end, seven felt they were somewhere in the middle, and two felt they were on the high end.*
>
> *—Focus Group Discussion: Facilitator's Notes, Region 3*

◆

FINDING #1:

Virginia's investments in education technologies are evident.

Still, students and educators in Virginia do not yet have adequate access to technology and associated electronic information.

There are significant disparities in student access to technology across school divisions.

Q: Is Virginia making progress in moving toward adequacy for technology access?

- In Virginia, the level of school and classroom access to technology, networks, and the Internet slightly exceeds the national average, but has not yet met the goals of the state's Six-Year Plan for Technology, nor the definition of the modern classroom described on the previous page.

National Comparisons for 1998	**Virginia**	**National**
Student-to-computer ratio for multimedia computers (Modern computers)	12:1	13:1
Students per instructional computer in classrooms	16:1	17:1
Students per instructional computer in labs	22:1	21:1
Students per instructional computer in libraries	98:1	114:1
Percent (%) classrooms with Internet access	55%	44%
Percent (%) schools with Internet access	91%	85%

Source: Market Data Retrieval as reported in Technology Counts '98 by *Education Week* and the Milken Exchange.

National reports indicate that the student-to-multimedia computer ratio varies widely, with some school divisions reporting a 1:1 ratio and others reporting up to a 32:1 ratio.

Within Virginia's school divisions, those ratios of students-to-multimedia computers extend into the 100+:1 for specific buildings.

- The data from this audit's surveys support national statistics indicating that approximately 56 to 58 percent of Virginia's classrooms have Internet connections. Unfortunately, that percentage ranges from 0 percent in some school divisions to 100 percent in others. Teachers are reporting that while the connection to the Internet may be there, there are not enough computers in the room to provide all students with sufficient access.

- In addition to classroom computers, many schools also have computer labs; middle and high schools frequently have several. On average, about half of the computers in computer labs are connected to the Internet.

- The preliminary data from this audit indicates a student-to-multimedia computer ratio of 10.9 to 1. A national report (Quality Education Data) indicates that the student-to-multimedia computer ratio ranges from 1:1 to 32:1 across Virginia's school divisions, with ratios into the 100+:1 in some buildings. The student-to-computer ratio for all computers is much lower, ranging from 1:1 to 9:1 across divisions, again jumping as high as 64:1 for some buildings. According to the teacher survey recently conducted in Virginia, the great majority of Virginia classrooms (90 percent) have at least one computer and some (29 percent) have four or more (although not all are multimedia or have Internet access). At all school levels, the average number of computers per classroom was four. Site-visit data and focus-group commentary suggest a wide range of student-to-computer ratios with significant differences between school divisions and school buildings.

- Statewide, teachers estimated that students in their classrooms spent about one-half of a class period per week, or 34 minutes, using computers for any reason. Principals gave a higher estimate, indicating that students spent an average of about one class period per week, or 48 minutes, using computers for educational purposes. Teachers indicate that student computer use is centered mostly on word processing and content-based drill-and-practice programs.

◆

Voices from the Field:

"We can't get students involved. I can only do so much with one computer. Right now I've got a lot of CD-ROMs in my room, but how do I get kids to use them?"

—high school social studies teacher in a rural school

Note: the annual budget in that school for the entire social studies department (for discretionary purposes) is $500

NOTE: If students had access to "pencils" for less than an hour per week it would be unlikely that they would be fluent writers and unlikely that a teacher would assign homework or learning activities that depended on the "pencil" and the process of writing.

- Patterns of technology access were often different for Virginia's elementary, middle, and secondary schools. Principals and teachers reported that elementary-school students spent more time per week using computers (51 minutes principals, 41 minutes teachers) than did middle- or secondary-school students (43 and 44 minutes principals, 24 and 29 minutes teachers). Elementary-school student use was usually limited to word processing and drill-and-practice, with less time on other computer applications and technology.

- Virginia schools are reporting that they do not yet have adequate levels of technology equipment and Internet access to meet their technology goals. Over 60 percent of principals reported that the current level of funding from both local and state funds is not sufficient.

At one middle school visited by researchers, five years ago there were six computers in the whole school; now there are 155 and they are used daily in instruction.

Figure 1.

Q—How well will the VA DOE & local funding allow your school to implement your technology goals? (Principal Survey: Q23)

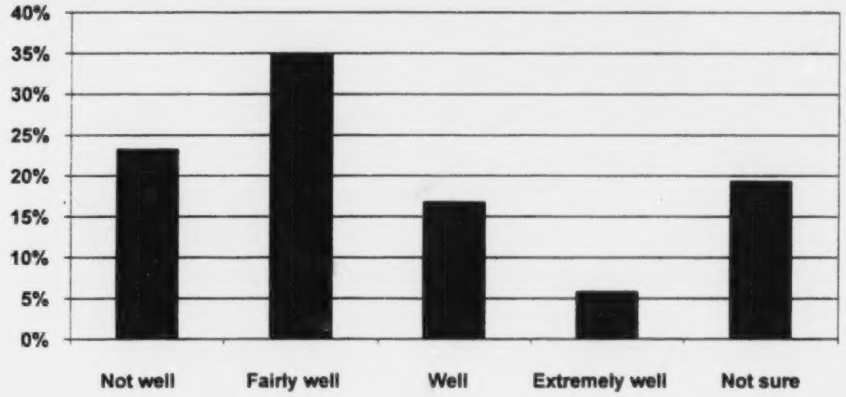


Table 1. Percent of Teachers Reporting Extensive Access to High and Low End Computers at School
—Please circle the number for your current level of access to the technology resources listed below...Teacher Survey: Q34

Computer Platform	Percent of Teachers Reporting "Extensive Access" Total for the state
Advanced Computer (PC—486, MAC-LCIII or better)	55%
Older Computer (PC—less than a 486, Apple II, IIe & MAC—less than an LCIII)	32%
Do not have "extensive access" to a computer at school	13%

- Table 1 indicates that 69 percent of all teachers are reporting extensive access to relatively modern computers for teaching and learning.

Table 2. Availability of Technology for Instructional Use by School Level
—Which of the following items are available for instructional use in your school? Principal Survey: Q36

Items Available for Instructional Use	Percent of Schools with Equipment				
	Total State	Level of School			
		Elem.	Middle	HS	Other
Color/laser printers	90%	90%	89%	90%	91%
Scanners/digitizers	80%	77%	84%	88%	75%
Video cameras, editing suites	79%	76%	86%	83%	74%
Digital cameras	74%	74%	82%	80%	57%
Graphing calculators	43%	18%	91%	94%	57%
Digital probes, sensors	21%	5%	49%	64%	17%
Optical laser lab equipment	10%	6%	19%	20%	9%

- The high percentages of access reported in Table 2 for graphing calculators at the middle and high school levels is a direct result of the policy decision by the Commonwealth in FY 96 to invest $20 million earmarked for that purpose.

- According to the teacher survey, there are considerable differences in classroom equipment across levels of schools. Overall, about one-half of the teachers said that they have at least one classroom computer connected to the Internet (58 percent). A higher proportion of elementary teachers (62 percent) and middle school teachers (59 percent) reported Internet access in their classrooms than did secondary teachers (44 percent). More suburban teachers (69 percent) reported having Internet than did rural or urban teachers (58 percent and 39 percent, respectively).

- Libraries are typically the first location in schools to be wired and they provide Virginia's students and teachers with computer-based research capabilities, frequently including access to the World Wide Web. According to *Technology Counts*, 84 percent of Virginia's school libraries have Internet access, compared to 70 percent nationally. [Note: This is an example of a policy action by the state (state appropriations in 1994 to increase access via libraries) that has had a definite result in the field.]

Q: Are all school divisions in Virginia making progress toward adequate technology access for students and teachers?

- Site visits indicated that per pupil technology budgets may vary by factors of more than 10 between school divisions. In some cases, the state's investment has been larger than the division's, while in other cases, the amount of funds the division has available for technology far exceeds the state contribution.

What was observed...

Extremes in funding for technology across the state are evident.

- Site visits revealed that—in several school divisions—spending on technology is at the level of $1,000 per student over a three- to five-year period, which far exceeds the amount allocated by the state. At the other extreme, some school divisions appear to allocate less than $100 per student over a comparable time period.

- In the installation and use of technology, suburban schools and divisions are clearly ahead of their urban and rural counterparts. Suburban schools are much more likely to have Internet; additional rooms with technology; scanners, digitizers and digital cameras; and distance learning capability.

Voices from the Field:

"It's a good start, but more support is needed from the state."

"I think that the state should help to ensure a basic technology infrastructure in every school and if divisions want to move beyond that, they can".

—focus-group discussion: Elementary Teacher, Region 1

Table 3. Availability of Technology for Instructional Use by School Community Type
—Which of the following items are available for instructional use in your school?
Principal Survey: Q34

Items Available for Instructional Purposes	Percent of Schools with Equipment			
	State Total	School Community Type		
		Urban	Suburban	Rural
Average % of Classrooms wired for Internet	56%	36%	75%	48%
Color/laser printers	90%	89%	89%	91%
Scanners/digitizers	80%	76%	87%	74%
Video cameras, editing suites	79%	77%	84%	74%
Digital cameras	74%	73%	80%	67%
Graphing calculators	43%	42%	40%	48%
Digital probes, sensors	21%	20%	22%	21%
Robotics equipment	13%	14%	14%	12%
Optical laser lab equipment	10%	9%	12%	10%

- In terms of technical support available to teachers, stark but predictable differences emerged across location of school—significantly more suburban principals than either urban or rural reported providing technical support (71 percent vs. 55 percent and 38 percent respectively).

The common barriers to increased use of computers in classrooms, as mentioned in the *site visits* conducted in October of 1998, were:

1) inadequate quantity and/or quality of equipment and software;

2) lack of adequate and timely technical assistance;

3) inadequate time for teachers to identify, learn and practice using the appropriate applications;

4) difficulty of accessing computers within schools;

5) network failures (often chronic);

6) inadequate access to the Internet;

7) too little professional development focusing on integrating technology into the curriculum.

- Focus-group discussions reflected this last point. Participants felt there was a lack of manpower necessary for the creation of an "ideal" technology learning environment. Focus group participants concluded that while technology might be available in the schools and classrooms, a lack of understanding regarding how to manage and use it keeps it from being integrated into daily instruction and learning. While the Virginia Standards of Learning (SOLs) are a core part of the learning context in the schools, educators are struggling with how to use technology effectively in teaching them.

Some Final Thoughts from Educators

Look before you leap. Think it through in a systemic way and follow through. DON'T PULL THE PLUG!

—Elementary School Principal, Region 1

When providing support, please consider all aspects of its intended purpose. Purchasing hardware needs to be supported by a human infrastructure to provide training, technical assistance, and help with repair and maintenance.

—Middle School Educator, Region 3

Always have at the forefront and basis of any plan that technology skills are not a luxury, they are life skills.

—Elementary Educator, Region 5

RECOMMENDATIONS ADDRESSING FINDING #1:

TECHNOLOGY CAPACITY AND COMMUNITY CONNECTIONS: Over the past four years, Virginia has invested significant resources in its technical infrastructure for schools.

The Commonwealth should now be thinking about:

- What defines adequacy regarding access to technology as an everyday teaching and learning tool for students and teachers?
- What ongoing funding levels will be necessary for schools and school divisions to reach adequacy and then to operate, maintain and stay current with technology for schools?
- What funding formula will be necessary to ensure that all school divisions make significant progress toward meeting and exceeding the goal of adequacy of technology access for all students and educators?

ADEQUACY and SUSTAINABILITY: In order to realize a full return on its initial investment in infrastructure, the state must "stay the course," reach adequacy for all learning environments, and strategically sustain that investment.

The Commonwealth should consider:

1 a) Staying the course, continuing to invest funds in the technology infrastructure to assure all students adequate access to technology by:

- Continuing to provide funding from state bonds for technologies, networks and connectivity. A continuation of this initial investment would build on the state appropriations of the past four years, reaching toward a critical mass of equipment, networking, software and technical support. This would continue Virginia's efforts to provide the infrastructure necessary for teachers to integrate technology into their everyday teaching and learning.
- Ensuring affordable, high-speed access to electronic resources for all schools and school divisions (e.g., a state-supported backbone, and/or aggregated purchasing for high-speed transport and connectivity services). The aggregation of educational traffic across one network could significantly reduce the cost of connectivity for all schools across the state. There are many state models, ranging from state ownership of the state system, to contracting of the entire network, to a hybrid model where the state owns hubs (switching stations and on-ramps for schools) but leases high-speed lines connecting the hubs. This is especially important for achieving equity through affordable access to high-speed, reliable connections for all schools.
- Establishing technical assistance models and technical support systems for school divisions and school buildings. In order for teachers to build lesson plans and learning activities around technology, there must be assurance

...to realize a full return on its initial investment in infrastructure, the state must:

- *"stay the course," to assure all students adequate access to technology;*
- *sustain and continually upgrade that investment; and*
- *establish a funding formula that assures equity*

that it will work reliably every day. The state should identify and support cost-effective models for provision of ongoing technical support. Many models exist, including outsourcing contracts to vendors; offering stipends to existing staff members; and developing expertise among students who learn as they support the school system's technical infrastructure.

- Updating and disseminating guidelines or standards for technology equipment, networking, facilities and connectivity. As schools are networked and modernized to handle technology and as architects and builders design and build new facilities, technology requirements will need incorporation. Guidelines or standards set by the state for networking designs, facilities and connectivity provide schools and school divisions with the information they need to wisely invest public funds at the local level. Educators in Virginia are asking for baselines and guidelines in this technical arena.

EQUITY: The disparities between the "haves" and the "have-nots" are exacerbated by technology, both for schools and for students. There are significant differences in the level of student and teacher access to technology among schools in the Commonwealth.

At the school level, the inequity is not only an access issue. It is also a teacher competency issue. A recent Educational Testing Service study on NAEP mathematics scores showed that knowledgeable teachers (in 8th-grade level mathematics) tend to use technology in the classroom in more substantive ways, leading to improved academic performance.

Another equity issue involves student access outside school hours. Students without access to technology in the home or at a community/public center are at a distinct disadvantage when it comes to completing homework assignments requiring research, writing, computing, processing, charting/graphing results and communicating. While this study does not address this issue, it is referenced in the Six-Year Plan.

The Commonwealth should consider:

1 b) Instituting a funding formula that assures equity by:

- Studying the equity issue and revising the funding formula. Virginia does not prorate the technology funding formula according to relative wealth of the school divisions, making it unique among funding formulas employed in the state. While that has allowed all school divisions to make some progress, the impact of state funds for the wealthier divisions is minimal, since it represents a small percentage of the total the school division spends on technology. In other school divisions, the state allocation represents a major portion of the technology investment. In addition, there is inequity in the cost of services across communities. In some of the more rural schools, the cost of a high-speed line to the Internet is significantly higher than in metropolitan areas. In addition, rural schools face challenges in attracting personnel for technical support, and it is costly to transport staff for professional growth opportunities. There are states which allocate state technology funds based on formulas that adjust for relative wealth, rurality and adequacy.

- Publicly funding schools to establish extended hours for community access to school labs and/or to provide technology access in community centers or public libraries. This would allow students access outside the school day. In addition, the visibility of technology and its expanded availability for the community would help to build a school-community relationship of trust and respect and could lead toward mutually beneficial partnerships related to technology.

FINDING #2:

Virginia's K-12 students and educators are gaining expertise in basic computer skills, but generally they are not yet using technology effectively to improve student learning.

Virginia's investment in learning technologies has launched schools into a cycle of innovation. Without more leadership and vision, however, Virginia's schools will not progress beyond the beginning stages of that cycle and will not fully realize the return on that investment.

Innovations often begin slowly, build toward rapid change, and then level off as the practice becomes prevalent. Both the adoption of devices (e.g., technology) and social innovations (e.g., kindergarten) typically take many years to reach full implementation. While Virginia schools build technology capacity, the goal of creating a learning environment that aligns standards, new approaches to learning and contemporary technologies has yet to be reached. It needs support through strong vision, leadership and resource allocation.

- According to principals and teachers, the emphasis placed on technology in their schools during the 1997-98 academic year was on basic computer operations. They were most likely to respond that "substantial" or "very much" emphasis was placed on basic computer operations (54 percent principals, 38 percent teachers).
- Fewer principals and teachers indicated that substantial emphasis was placed on training in new uses of technology that enhance student learning or their own professional growth (e.g., "unique learning opportunities for students"; "contexts for independent learning"; using technology to "participate in professional networks and advance practice").

Consensus among the teachers and administrators in the focus groups was that students can benefit from the proper use of technology, especially in terms of problem-solving, organization, research skills and taking responsibility for their own learning. Most participants, however, did not believe they were there yet.

Voices from the Field:

"The state may have a vision, but I'm not sure they've communicated it to (schools) and I'm not sure they know how to get 'there.'"
—focus-group discussion
Elementary Principal
Region

What was observed...
Use of technology in Virginia schools is at a basic level.

Based on the site visits, frequent uses of technology in Virginia schools seemed to be remedial skill work, drill-and-practice, word processing and library research. Technology use is also common in vocational, business, technology, and special education classes. But technology integration for teaching concepts, supporting group projects or other activities, apart from skills and drills, seemed to be less frequent in high schools (with the exception of the graphing calculator, used in several mathematics classes).

Teachers were using technology for administrative tasks and in preparation and delivery of instruction, but in most cases not for providing learning opportunities in which students were asked to use technology.

About seven out of 10 teachers used computers on one or more activities for longer than an hour a week. Only two percent of the teachers surveyed reported using technology less than 15 minutes per week or not at all. Generally, the majority of the time teachers spent with computers involved lesson preparation (word processing or Internet research), followed by instructing students, checking or recording student scores, and finally, communicating with colleagues.

These findings are consistent with research from the Educational Testing Service recently reported in "Technology Counts '98" by Education Week and the Milken Exchange. In the study, teachers reported using technology in 4th grade math classes, and yet the majority of their students reported NOT using technology in those same classes. For example: 91 percent of Virginia's 4th graders had "teachers who reported using technology as a primary tool in mathematics classes," yet 68 percent of the 4th graders reported not using technology in their mathematics classes. This may be an indicator that teachers are using it for administration or demonstration purposes, but students do not actually access the technology for learning purposes.

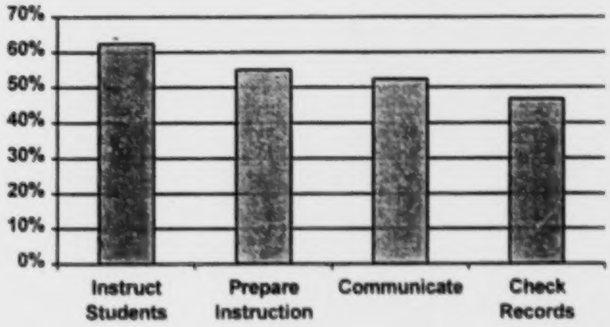
Voices from the Field:

The need for support in using technology is evident...

"No teacher wants to teach what he or she hasn't mastered. Teachers are willing and anxious to learn but need to be taught."
—focus-group discussion: Middle School Teacher, Region 8

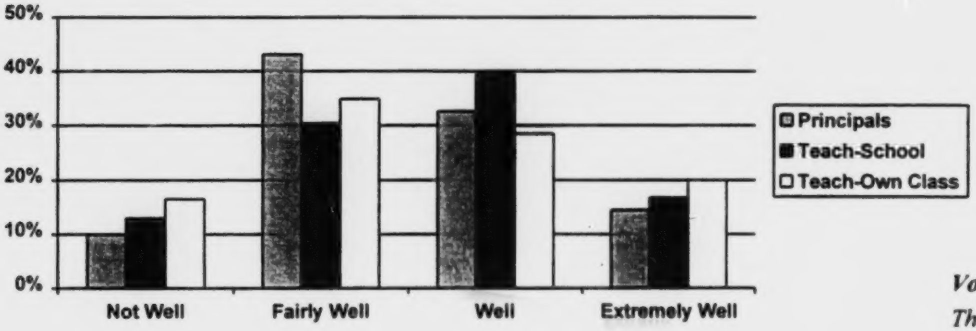
"[The challenge is] the promise of what we can do with technology, and the fear of having to do it."
—focus-group discussion: Elementary Principal, Region 1

Figure 2. Principal Estimates of Percentages of Teachers Using Technology for Instructional Activities



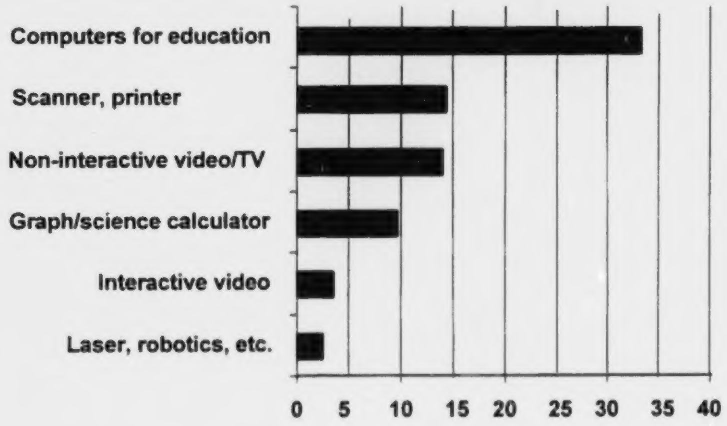
Teachers were a little more positive in their ratings regarding the integration of technology into the overall school, with fifty-seven percent marking it "extremely well" or "well" integrated. When asked how well technology is integrated into learning in their *own* classrooms, teachers gave a wider range of answers than when rating the whole school; higher percentages rated either not well (17 percent) or extremely well (20 percent) when assessing their own integration of technology into learning. There were no differences between elementary, middle, or secondary schools or between urban, suburban, or rural schools on this question. Researchers observed through the site visits that teachers whose pedagogical approach already favored student-centered group work appeared to more readily integrate technology into the curriculum in meaningful ways, compared to teachers who didn't typically engage students in group work.

Figure 3. Principal and Teacher Ratings of How Well Technology is Integrated Into Learning in Their School and Own Classroom (Teachers Only)



- On average, teachers report that their students spend about 34 minutes per week using computers in the learning environment. They also report that elementary students use computers for more minutes in a day than do middle or secondary students.

Figure 4. Average number of minutes per week spent by students using various technologies in the learning environment (Teacher Survey: Q17)



Focus Group: Consensus was that students should benefit from the proper use of technology, especially in terms of problem-solving, organizational and research skills, and responsibility for their own learning. One teacher said she felt they were not to the point yet where students' basic skills could be said to improve because they are not using technology to its fullest: "I don't think we're integrating technology into instruction. We're using it more as remediation or independent learning." (Focus group discussion: Facilitator's Notes, Region 3 Middle and High Schools.)

Voices from the Field:

The promise for learning with technology is there, but use is still at a basic level...

"Optimally, I would like to have at least four computers with Internet capabilities; students would have access to laptops and graphing calculators; they would be taking notes, doing word processing, using CD-ROMS as resources, conducting research..."

—focus-group discussion: Teacher, Region 4

One teacher described a situation where three new teachers brought their laptops to school the first day with their PowerPoint presentations ready to go, only to find that the school didn't have the necessary software and projection equipment to support PowerPoint.

—focus group discussion: Facilitator's Notes, Region 3 Middle and High Schools

On the whole, students are only just beginning to use technology for more varied and sophisticated applications. Teachers report students using the computer for word processing in nearly two out of three classrooms (70 percent); followed by content drill-and-practice (63 percent), CD-ROMs (51 percent), Internet-based research (45 percent) and simulations (32 percent). Lesser-used computer applications are databases, spreadsheets, and Web page design software (this occurs in fewer than 25 percent of classrooms).

The figures below suggest that students in Virginia are beginning to use technology for simple tasks such as word processing and drill-and-practice (e.g., practicing math facts). They are also beginning to use the technology for some higher level activities such as research (on CD or the Internet), but have yet to apply complex applications such as databases, spreadsheets and Web page development in academic classrooms to any great extent.

> *I don't think we're integrating technology into instruction. We're using it more as remediation or independent learning.*
>
> —*Teacher, Region 3*

Figure 4a. Percentage of classrooms using various computer applications (Teacher Survey: Q17)

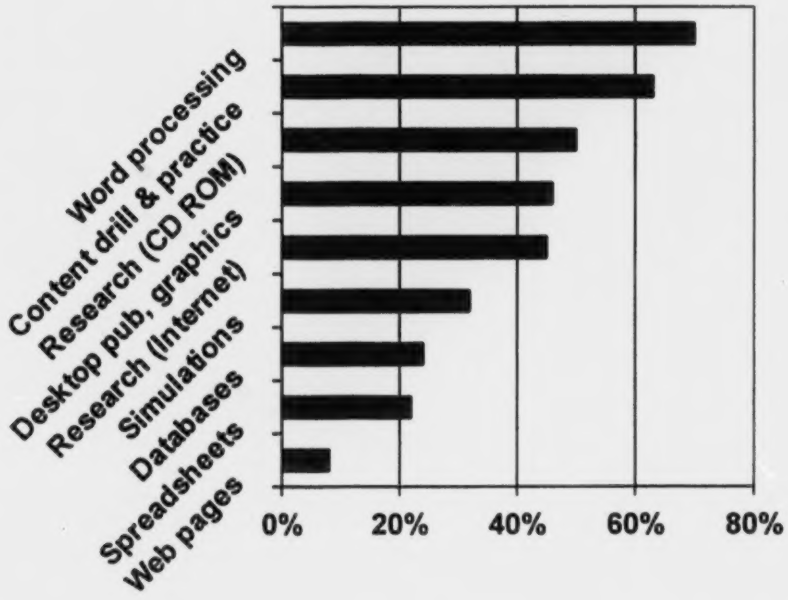


Table 4. Principal and Teacher Ratings of Technology's Impact on Student Learning in Curriculum Areas

Area of Impact	Principal Ratings		Teacher Ratings	
	Much Improved	Somewhat Improved	Much Improved	Somewhat Improved
Knowledge in English	17%	66%	19%	53%
Overall level of academic achievement	14%	75%	18%	66%
Understanding the "basics" in the subjects you teach [a]	–	–	18%	52%
Knowledge in science	13%	63%	16%	54%
The *breadth* of students' under-standing of the subject(s) you teach [a]	–	–	15% [b]	55% [b]
Knowledge in history/social science	8%	63%	14%	52%
The *depth* of students' understanding of the subject(s) you teach [a]	–	–	13% [b]	55% [b]
Knowledge in mathematics	13%	69%	12%	60%

[a] Question asked only on teacher survey

[b] Much Increased and Somewhat Increased

Table 5. Principal and Teacher Ratings of Technology's Impact on Relevancy of Student Learning Experiences

Area of Impact	Principal Ratings		Teacher Ratings	
	Much Improved	Somewhat Improved	Much Improved	Somewhat Improved
Higher-level skills (e.g. problem-solving, constructing knowledge)	17%	65%	20%	56%
Communicating and sharing ideas with others outside the school	20%	56% [b]	20% [b]	53% [b]
Ability to set their own pace for learning	14%	52%	19%	42%
Students' independence as learners [a]	–	–	18%	61%
Student engagement in inquiry-based learning projects [a]	–	–	18% [b]	61% [b]

[a] Question asked only on teacher survey

[b] Much Increased and Somewhat Increased

Teachers expressed that they needed time to learn about applications, practice new skills, observe other teachers, talk with colleagues, and learn how to manage a new set of resources (including how best to organize classrooms for students to use technology effectively).

RECOMMENDATIONS ADDRESSING FINDING #2:

LEARNERS AND LEARNING ENVIRONMENTS: Most schools are not changing their approaches to teaching and learning in order to effectively use technology to advance student learning.

A vision for learning technology has been developed by key stakeholders in the state and articulated in the Six-Year State Technology Plan. But Virginia educators are not generally aware of that vision nor how to translate it into effective classroom practice. There seems to be a great deal of enthusiasm for technology among educators and students, but a real lack of innovative models and forward-looking visions of effective uses for technology in schools.

The Commonwealth should consider:

2 a) Providing proactive state leadership by:

- Broadening the vision of learning technology and providing state leadership that guides and directs schools toward that vision. Specifically, the Virginia Technology Advisory Committee should broaden the vision in the state technology plan. The legislature should direct and fund the state education agency to provide proactive statewide leadership in translating that vision into exemplary, effective classroom practice. Prototypes and models for increasing academic achievement across the Standards of Learning should be designed, implemented, researched and documented under state leadership.

2 b) Translating the state vision into classroom practice by:

- Establishing state programs for all content areas that provide teachers with all of the "essential conditions" necessary to engage them and their students in effective uses of technology. Research suggests that until teachers begin engaging in exemplary technology application with their students, they don't fully realize the possible potential of technology to enhance and extend learning. The state could capitalize on the insights gained through such research. One way to do this would be to involve key Virginia educators in establishing prototypes that create an umbrella for novice teachers to begin engaging their students (and themselves) in effective uses of technology for specific content areas.

2 c) Linking the state's future investments to effective practice by:

- Tying technology funding to adopted models of success that use technology effectively across academic content areas. The state should summarize research on the effective uses of technology and identify frameworks for the essential conditions necessary to use technology effectively in academic areas. All funding for school technology should require that school personnel design technology plans within those frameworks. Other states are using technology grant money to target prototypes of new designs for teaching and learning. And at least one (Illinois) has adopted a framework for "engaged learning through technology" and ties allocation of specific grants to associated criteria.

◆

Most schools are not changing their approaches to teaching and learning in order to effectively use technology to advance student learning.

...to ensure that the technology in Virginia schools has a positive effect on student learning, the state must provide:

- *proactive leadership;*
- *models for effective uses of technology in all content areas;*
- *information on research and effective practice; and*
- *financial support linked to the criteria for effective practice.*

- Establishing support systems for educators in key areas, including technical support, support for changing curriculum and instruction to make the best use of technology.

Another model for creating effective uses of technology is to create expert teachers and staff developers in technology. When their expert status as content developers is combined with increased exposure to technology applications, they can go a long way in convincing novices that technology can and should be used to gain significant improvements in student performance.

Such experiences serve as new, different and effective professional development models where teachers' changing practices directly affect students' academic performance. This would also build strong "virtual" networks among educators who are working together to improve learning through technology. This type of prototype allows a teacher or a team of teachers and students to join exemplary technology-enriched academic projects and get the requisite experience needed to design their own curriculum and instruction with technology.

Finding #3:

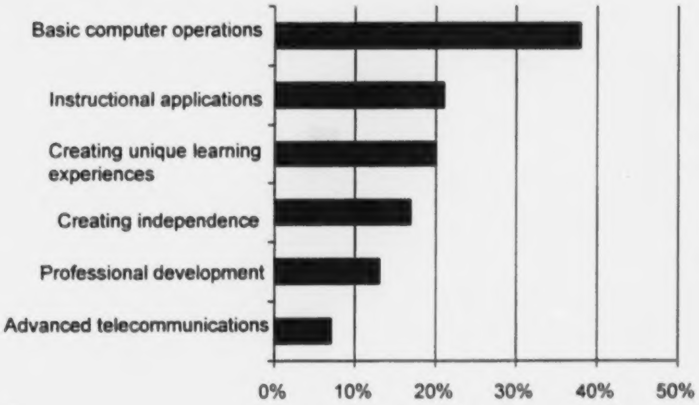
The Commonwealth lacks many of the essential conditions necessary for effective use of technology in schools. These are: support for proactive, visionary leadership; flexible, stable revenue streams; high quality, content-based professional development; access to model content-based projects; and technical assistance for schools.

The issue of effectively using technology is now at least as important to progress in Virginia as the nature and amount of technology equipment, networking and software in schools.

There is a need for more technology in schools. Yet study results indicate that there are other important unmet needs as well. In terms of professional development, while educators in Virginia are acquiring skills in the use of technology, they have not yet acquired the knowledge and ability to use technology effectively in ways that add significant value to student learning and performance. Furthermore, there is a strong need to build system capacity, as evidenced by many schools reporting insufficient technical support as a significant barrier to effective technology use.

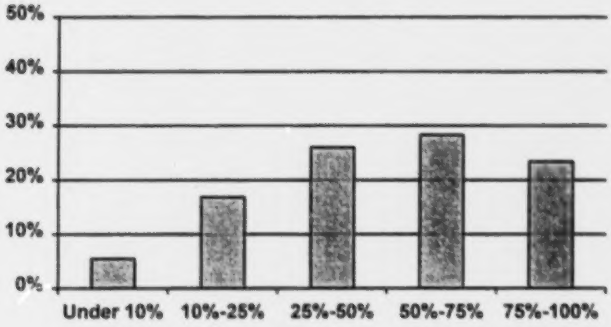
- Thirty-five percent of the teachers rated themselves as "very well" or "well" prepared for using technology in instruction. Almost half (46 percent) said they were "moderately well" prepared; and one-fifth (19 percent) said they were not prepared. In looking at specific skills, however, only about one-in-five rated themselves as "advanced" in using the computer for instructional applications.

Figure 5. Teacher self-rating of computer skills—Percent indicating "Advanced" (Teacher Survey: Q25)



- Almost one-half of the principals (48 percent) said that half of their teachers do not meet or exceed the Technology Standards for Instructional Personnel.

Figure 6. Principals' Estimates of Percentages of Teachers Who Meet or Exceed the Virginia Technology Standards for Instructional Personnel



- What study researchers found through the site visits was that student motivation was usually correlated to teachers' comfort with using technology, ready access to technology in the classrooms, and adequate support within buildings and by school divisions.

What was observed...
Technology standards for instructional personnel are widely accepted.

While some teachers may not be meeting the Technology Standards for Instructional Personnel, based on the site visits, principals and teachers seem to believe that these standards do make sense and are "here to stay." Many teachers are participating in professional development to learn more about technology and to meet these standards, sometimes with the support of the school division. For example, one division is focusing this year on helping teachers meet Standards 1, 2, and 8.

- Technology training through local sources seems to be the most commonly available and used by teachers. Almost all teachers (95 percent) said local technology training that was "informal, self-taught, and as time allowed" was available through their schools and that they took advantage of it.

NOTE: This data suggests that professional development in learning technology for a number of Virginia's teachers is not within a carefully devised professional growth plan, but rather an informal process of learning, at the teacher's own initiative.

- Less common resources for professional development were collaborative teams of teachers (54 percent of teachers responding to the survey said this was available); regional consortiums (50 percent of the teachers said this was available); and the Virginia Department of Education (44 percent of teachers said this was available).

Voices from the Field:

The majority of teachers want to learn to effectively use technology, but need support to do so.

"I think teachers are coming on board more and more, it's just a matter of time...but we need more and better training."

—focus-group discussion: Teacher, Region 4

One teacher explained that often after teachers have been exposed to the "state-of-the-art" instructional software and hardware in formal workshops, they return to schools that have models of computers that cannot support these latest applications.

—focus-group discussion: Facilitator's Notes, Region 7 Elementary Schools

What was observed...

Time and money are barriers to increased technological competency.

In every school division, teachers are making major efforts to increase their knowledge and skills in the use of technology. Nevertheless, during site visits teachers cited the lack of time and funds as major barriers that limit their ability to achieve increased proficiency in technology. Although some divisions help subsidize technology-training costs, many teachers indicated they must use their own resources and their own time to increase their professional competency.

- We asked principals several items about the technical support available to teachers. For an overall picture, only 56 percent reported having a staff member who dedicated at least 20 percent Full Time Equivalent (about 8 hours a week) to supporting teachers' use of instructional technology.
- We also asked principals about the availability of division-level support specialists for hardware, software, and network problems. The percent indicating availability was 88 percent for hardware; 84 percent for network; and 75 percent for software.

◆

***Voices from the Field**:*

There is a need for a "systems" approach to accessing and using technology.

While most of the participants felt that the state's vision for educational technology was ambitious, many teachers expressed the feeling that on a day-to-day basis, they were 'out there doing it alone'. That is, they felt that they lacked the expertise and school-level support needed to use the equipment effectively and with confidence.

—focus-group D Facilitator's Notes, Region 6 Elementary Schools

RECOMMENDATIONS ADDRESSING FINDING #3:

FUNDING SYSTEMS THINKING AND PROFESSIONAL COMPETENCY: As recently as five years ago, many Virginia schools were literally without learning technologies.

The Commonwealth should recognize that change takes time. Incorporating technology into schools in ways that ultimately enrich and improve student learning is a complex undertaking and will require systems thinking and change management across all levels of the education system.

The state has engaged stakeholders in developing a vision, but most educators are not aware of what that vision is nor what it "looks" like when translated into classroom practice. Nor do those educators have the requisite knowledge and skills to implement that vision. The state has invested significant public funds in capital investments but does not have a state-level revenue source for non-capital technology investments. That fact limits the flexibility of local schools and school divisions, requiring that they spend most state-provisioned technology funds on equipment, networks and connectivity. Since bond proceeds can only be used to pay for specific capital investments such as hardware and wiring, other critical components—such as teacher training, ongoing maintenance and support systems—have been left to what the school divisions and schools could afford on their own.

To date, there has not been a review of existing policies and procedures to ensure alignment with the vision for learning technologies, and there has been little investment in state leadership to build the capacity of schools to reach the state vision.

The Commonwealth should consider:

3 a) Providing quality leadership for educators to meet and exceed high standards for learning set by the state:

- Maintaining high standards for technological competency among teachers and administrators, and providing the means to achieve such standards. Pre-service teachers in Virginia are required to meet technology-related requirements in order to receive their initial teaching credential. Virginia currently does not have similar requirements for administrators. Uniform performance standards for all colleges of education would ensure that all new teachers have met or exceeded these requirements. The International Society for Technology in Education will be updating the national technology standards for teachers by June of 1999. The Commonwealth should consider a review of their current requirements when the updated national standards are released.

- Maintaining high standards for technological competency among practicing teachers and creating state support systems for their professional growth that directly link to the improvement of student learning (e.g., learning technology centers, professional development models, statewide prototypes).

Incorporating technology into schools in ways that ultimately enrich and improve student learning is a complex undertaking and will require systems thinking and change management across all levels of the education system.

Voices from the Field:

If the state is asking educators to be proficient in technology and ensure that students are proficient, then the state must help schools with the means (capacity, professional competency, technical support, etc.) to do so.

—focus-group discussion: Middle School Teacher, Region 3

3 b) Requiring systems thinking through state, district and building-based technology/school improvement plans that focus on learning:

- Systematically updating, funding, implementing and assessing the Six-Year Technology Plan. Parallel school division technology planning should be supported and should be a requirement to access state technology funds. Some funds will be required for leadership activities at the state education agency. This would enable state personnel to assist school divisions in developing and periodically updating quality technology plans at the local level that are learner-centered, community-based and integrated into school improvement plans. The state should provide a framework and rubric for quality plans and continue facilitating a peer-review process for those plans.

- Supporting statewide purchasing of hardware, software and online services to aggregate buying power and ensure that all schools have access to content through the state-provisioned infrastructure. Several states are now acquiring statewide rights to software and online services for all students and educators, and some are securing state bids for deep discounts on technology equipment and resources. For example, Florida, Utah and Illinois now provide statewide rights to online services such as electronic encyclopedias and curriculum materials. Many states allow school divisions to buy off state bids for hardware or bid on the school division's behalf.

3 c) Establishing an ongoing, stable revenue stream to support system capacity in the state (in addition to continued funding for infrastructure from state bonds).

Currently, the state technology funding through bonds provides literally no flexibility to school divisions. The dramatic increase in technology infrastructure and student/teacher access is a direct result of this targeted funding. However, if the state is to take full advantage of this current investment, state funding should be provided that allows school divisions and schools to allocate funds to needed areas like professional development, software acquisition, curriculum redesign, technology planning, etc.

The national range in state technology funding is from $441 per pupil over the last five years in Ohio to $6 in a northwest state. Virginia has allocated $113 total per student since 1994, ranking 11th out of the 36 states reporting data in this area. The majority of states have revenue sources from general revenues. That allows flexibility of allocation beyond technology equipment and connectivity to professional development, prototyping, software, online services, etc.

Only three other states require practicing teachers to meet technology-related continuing education requirements to maintain their credentials. Five more states are in process toward such a requirement. In Virginia, the adoption of performance standards for the existing requirements for practicing teachers (Technology Standards for Instructional Personnel) would assure the Commonwealth of uniform quality across school divisions. Currently, performance standards are left to the divisions.

Teachers in Virginia want to incorporate technologies into their classrooms but do not know how to do so effectively. A state-level framework for developing professional competency with technology would serve as a roadmap for their professional growth.

Virginia *does* require school divisions to spend 20-25 percent of selected state technology funding on professional development. However, the data from this survey shows that, for the most part, professional development is directly dependent on the initiative of individual teachers and is not systematically planned—nor in some cases supported—by local divisions or the state.

For the long term, professional growth opportunities in learning will be required. A systemic approach would establish regional support systems that proactively translate the vision and model into effective classroom practice for teachers and effective management of change for administrators.

Thirty-three states have state-supported professional development centers for learning technologies. Twenty-four states currently support statewide or regional "train the trainers" programs, with most of those focusing on professional development programs that integrate technology into content areas.

FINDING #4:

The technology use in Virginia schools focuses primarily on skill development rather than on the use of the technology to advance student learning across the core Standards of Learning.

Students should be using technology in ways that deepen their understanding of content in the academic standards and advance their knowledge of the world around them. Furthermore, in addressing accountability, there should be a general consensus of what success with technology looks like and measures must be in place to track progress and report results.

When it comes to acquiring technology skills, some principals and teachers believe that the technology-specific SOLs deserve continued attention and development as a way of measuring technology skills and application. Nationally, experts are debating whether the pencil and paper test for technology proficiency is a valid and credible form of measurement.

However, several focus group participants indicated that the state is emphasizing integrating technology throughout the curriculum, but it has established SOLs for technology that are separate from the academic content SOLs and is testing them separately. The participants asked for a more consistent approach that would embed the technology skills at appropriate points. Teachers seem unclear as to technology's role in supporting the core SOLs.

The reality–given the clear focus on SOLs–is that if technology is not specifically mentioned within an academic SOL it probably will not be used as a teaching and learning tool in that area.

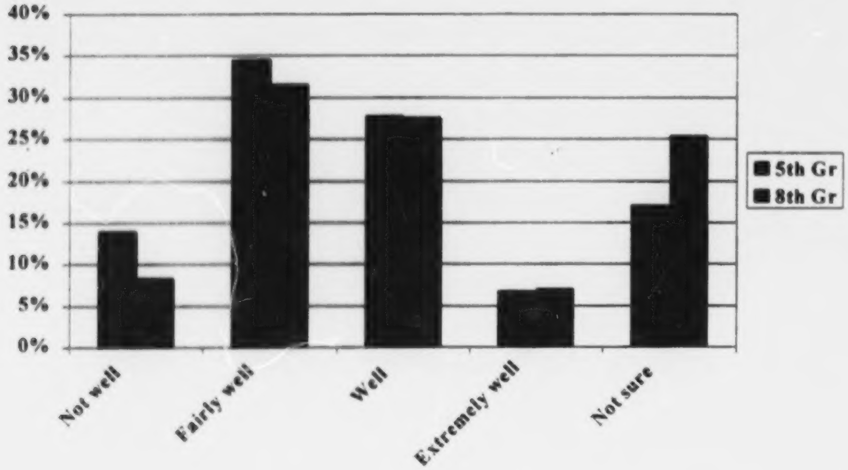
- Virginia's focus on separate SOLs for technology translates into teachers' practices that focus on developing students' basic technology skills more than integrating technology across the curriculum.

- Over one-third of 8th-grade teachers (41 percent) believed that at least one-half of their students did not meet or exceed the SOL standard for Computer/Technology.

- When asked how well their students met or exceeded the SOL for Computers/Technology, fewer than eight percent of principals surveyed said "extremely well" and a significant proportion (17 percent of elementary principals and 25 percent of middle school principals) were "not sure" about how well their students performed on these standards.

Note: In November, the Virginia Department of Education reported that, at the 5th grade, 72 percent of the students passed the test on Technology SOLs and, at the 8th grade, 63 percent of the students met or exceeded the Technology SOLs.

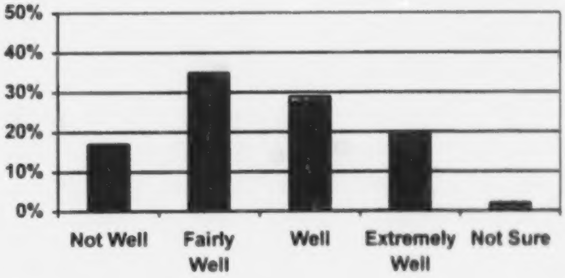
Figure 7. (Principal Survey: Q6 & Q7) How well did your students meet or exceed the SOL for Computers/Technology?



- In general, schools in Virginia are not significantly changing their approach to teaching and learning in order to effectively use technology to advance student learning. Fewer than one out of five teachers surveyed (20 percent) believed that technology was being integrated well into their own classrooms.

It should be noted that these surveys were conducted prior to the Department of Education's publication of state scores across various Standards of Learning and prior to the establishment of the cut scores by the State Board of Education. A question that bears future investigation is how well a paper and pencil test is able to assess technology standards, particularly as teachers begin to meet the technology requirements within the core Standards of Learning.

Figure 8. How well is technology integrated into learning in your classroom/courses? (Teacher Survey: Q16)



***Voices from the Field:** Mixed feelings about the Technology SOLs.*

On the alignment of the Technology SOLs with what is actually tested: "The technology SOLs say you should now know the alphabet, but the test is only about 'H,' or you should [know] everything about the car and the test is only about brakes."

—focus-group discussion: Middle School Principal, Richmond City Schools

Some participants questioned why the Technology SOLs ended with 8th grade.

—focus-group discussion: Facilitator's Notes, Region 8

"Fifth graders are supposed to explain bytes and binary logic [as part of Technology SOLs], but the state doesn't explain why. We need to know not only the SOLs, but the rationale behind them."

—focus-group discussion: Middle School Teacher, Region 2

What was observed...
Impact of technology on academic success... too early to reach conclusions.

While there may be evidence available to support the effectiveness of technology in certain domains (e.g., special education, business/vocational education), and anecdotal accounts of students using technology to perform academic tasks more accurately and more efficiently, the data on student performance gathered from site visits is inconclusive. This seems partly because the integration of technology into the classroom curriculum is in the early stages at many Virginia schools.

Some of the accounts emerging from site visits indicate that student writing, research, and presentation skills *have improved* as a result of using computer technology. Also, the reinforcement of skills, via computer drill-and-practice, is perceived by many teachers to have positive impacts on student test scores.

Voices from the Field:

"The SOLs provide the objectives to be reached by students at each level. What is missing is the direction of how to attain it with technology.

For example, one SOL states that students will create projects using technology. Does the state assume we have LCD projectors and digital cameras to do this? We don't. How do they envision the SOLs being accomplished?"

—focus-group discussion: Middle School Teacher, Region 4

RECOMMENDATIONS ADDRESSING FINDING #4

ACCOUNTABILITY AND SYSTEM CAPACITY: Sound, forward-thinking state policy will be required to translate the state's vision for learning technology into effective classroom practice and increased student learning. This is a long-term goal that will be achieved over the next decade incrementally, by setting and attaining an interim set of milestones.

The Commonwealth should consider

4 a) Promoting the use of technology to support and bring relevance to the current academic SOL:

- In the short-term, designing strategies to apply technologies toward the improvement of student achievement across the SOLs. Teachers and students across Virginia have access to some technology and are beginning to build their ability to use it. The next logical steps are to identify problem areas in the achievement of SOLs and develop, prototype, research and disseminate information on the most effective instructional strategies that lead to student gains on state tests for the SOLs.

- Designing, prototyping and implementing reliable and credible assessments of students' abilities to apply technologies, solve problems and improve learning across the academic SOLs. Virginia educators seem to agree that the ultimate goal for education technology is not simply proficiency with tools but the application of that knowledge to problem solving, accomplishment of meaningful tasks and extension of understanding and learning. In order to systematically achieve this in all schools, for all students, such outcomes need to be clearly articulated and measures need to be in place which provide clear evidence of success. To begin with, a sampling approach may be necessary due to the cost of such performance testing and the lack of adequate access to technology by schools.

4 b) Ensuring that state learning goals reflect the digital, information age:

- As schools become technologically savvy, it is important to review and revise the Standards of Learning to reflect new technology the knowledge-based society.

- New measures should be designed to assess the technology-enriched standards. In the long term, it is important to note that what gets tested, gets taught. Within the next few years, if schools reach adequacy levels for technology access and gain knowledge and insight into how technology can accelerate and deepen student understanding of academics (and increase scores on the state SOL tests), the logical next step will be to revise the SOLs to reflect the impact of technology on those content areas. Virginia is one of only seven states that have stand-alone technology standards as well as technology standards integrated into all academic standards. Thirty-five states are integrating technology into academic standards and do not have stand-alone standards. Fifteen have no standards with respect to technology.

...Sound, forward-thinking state policy will be required to translate the state vision for learning technology into effective classroom practice and increased student learning.

In the near term:

- *teachers need assistance in applying the technology to academics; and*
- *more credible assessments are needed to gauge students' abilities to effectively use technologies to communicate, research, solve problems, and learn new concepts*

In the future:

- *the SOLs will need to be reviewed and updated to reflect contemporary uses of technology in society; and*
- *assessments need to stay aligned to such changes in the SOLs.*

Students in the 21st century will need schools with 21st century learning goals. Science and mathematics (bio-genetics, space travel, simulations, modeling, etc.), language arts and communication (visual images, email, the Internet, word processing, desktop layout and design, digital photography and editing, etc.) and social studies (politics, global economies, transportation, trade, global manufacturing, virtual companies, FDA regulations, etc.) have all been transformed by emerging technologies. Virginia's SOLs need to reflect these significant societal changes.

Summary of Key Findings and Recommendations for Next Steps

1. **While Virginia's investments in education technology are evident in schools, the level of technology access is not yet adequate and there are significant disparities in student access across school divisions and between schools within divisions.**

   The Commonwealth should consider:

   1 a) Staying the course, continuing to invest funds in the technology infrastructure to assure all students adequate access to technology by:

   - Continuing to provide funding, from state bonds, for technologies, networks and connectivity.
   - Establishing affordable, high-speed access to electronic resources for all schools and school divisions (e.g., state-supported backbone, aggregated purchasing for connectivity services).
   - Establishing technical assistance models and technical support systems for school divisions and school buildings.
   - Updating and disseminating technology guidelines or standards related to networking, facilities and connectivity.

   1 b) Instituting a funding formula that assures equity by:

   - Studying the equity issue and revising the funding formula to assure equity.
   - Allowing schools to allocate state and federal funds to establish extended hours for community access to school labs and providing technology access for students in community centers or public libraries.
   - Establishing state programs for all content areas that provide teachers with the "essential conditions" necessary to engage them and their students in effective uses of technology.

2. **Virginia's K-12 students and educators are gaining expertise in basic computer skills, but in general, they are not yet using technology effectively to improve student learning across the core academics.**

   The Commonwealth should consider:

   2 a) Providing state leadership by:

   - Broadening the vision of learning technology and providing state leadership that guides and directs schools toward that vision.

- Translating that vision into common classroom practice through state supported models and prototypes; and providing information on research and effective practice.

2 b) Translating the state vision into classroom practice by:

- Tying technology funding to adopted models of success that use technology effectively across the content areas.

2 c) Linking the state's future investments to effective practice by:

- Establishing support systems for educators in key areas including technical support as well as support for changing curriculum and instruction to make the best use of technology.

3. **The Commonwealth lacks many of the essential conditions necessary for effective use of technology in schools: support for proactive, visionary leadership; high quality, content-based professional development; access to model content-based projects and technical assistance for schools.**

The Commonwealth should consider:

3 a) Providing quality opportunities for educators to meet and exceed high standards for learning set by the states by:

- Maintaining high standards for technology competencies for pre-service teachers and administrators and the means to achieve such standards.

- Maintaining high standards of technology competencies for practicing teachers and administrators and creating state support systems for professional growth which link to improved student learning (e.g., learning technology centers, professional development models, statewide prototypes).

3 b) Requiring systems thinking through state, district and building-based technology/school improvement plans that focus on learning by:

- Systematically updating, funding, implementing and assessing the Six-Year Technology Plan. Parallel school-division technology planning needs support and it is recommend that it be required for access to state technology funds.

- Supporting statewide purchasing of hardware, software and online services to aggregate buying power and to ensure that all schools have access to content through the state-provisioned infrastructure.

3 c) Establishing an ongoing, stable revenue stream to support system capacity in the state (in addition to maintaining the funding for technology infrastructure from state bonds).

4. The technology focus in Virginia schools is on skill development rather than technology use to advance student learning across the core Standards of Learning.

The Commonwealth should consider:

4 a) Promoting the use of technology to support and bring relevance to the current academic SOLs by:

- Designing strategies for technology use so as to improve instruction that supports student achievement across the SOLs.

- Designing, prototyping and implementing reliable and credible assessments of students' abilities to apply technologies, solve problems and improve learning across the academic SOLs;

4 b) Ensuring that state learning goals reflect the digital, information age:

- In the future, reviewing and revising the Standards of Learning to reflect technology and the knowledge-based society, especially as schools become more technologically savvy.

- Designing and implementing new measures to assess the technology-enriched standards.

State of the Commonwealth in Learning Technologies:

A National Perspective

Virginia has made great strides in building a technology infrastructure to support the use of learning technology. Over the past five years, the Commonwealth has invested over $200 million in education technology. According to a 1998 policy survey by the Milken Exchange, that five-year total of $220 per student ranks Virginia in the top 11 states of the 35 reporting data. (The range was from a total of $441 per student in Ohio to a low of $6 in a northwest state.)

Since most of the state allocation came from state bonds, the state allocations have been primarily restricted to capital investments. Virginia is only one of seven states in which a substantial percentage of the technology budget for schools comes from sources other than the state general fund. Less than three states have this type of restriction on capital investment.

The Commonwealth exceeds the national average student-to-computer ratio. Virginia's ratio of students per instructional multimedia computer for 1998 is 12:1, according to *Market Data Retrieval*. The national average for 1998 is 13:1, according to the same source. Having accomplished great progress on this front, it is now time for the Commonwealth to turn its attention towards leveraging its investment. Educators across the state have not yet begun to tap into the full potential of technology for learning.

Despite these tremendous gains, there is much to accomplish in the area of technology infrastructure. Equity is a growing concern, and many educators report that technology capacity, though much improved, is not yet adequate.

To tap into the full potential of technology for learning, the state needs to implement policy actions in the areas of:

- vision
- leadership
- systems thinking
- funding sources providing local flexibility
- new models for learning and teaching
- knowledgeable educators (re: technology)
- accountability

The challenge is that of recognizing technology's potential, then making the hard choices and policy decisions to ensure it is used responsibly and effectively.

Results: A Triangulation of Data Collected in Focus Groups, Site Visits, and Surveys

THE STATUS OF TECHNOLOGY AVAILABILITY AND USE IN VIRGINIA SCHOOLS

This *results* section synthesizes data from the three research methods used for this study and evaluates it according to measures of technology success in schools developed by the Milken Exchange, titled *The Seven Dimensions for Gauging Progress.*

The sources from which these results are drawn are:

- two surveys—of 1,634 school principals and 1,121 teachers, representing a statistically valid cross section of Virginia schools' communities;
- focus groups—representing teachers, support staff, school administrators and members of the Virginia Education Technology Advisory Committee;
- site visits—to 48 schools within 16 school divisions of Virginia, representing elementary, middle and high schools and a wide variety of urban, rural and suburban locations.

The results are broken down into the Seven Dimensions: Learners; Learning Environments; Professional Competency; System Capacity; Community Connections; Technology Capacity; and Accountability. There are also several subdivisions within each dimension.

LEARNERS

Are learners using technology in ways that deepen their understanding of academic content and, at the same time, advance their knowledge of the world around them?

Educators and administrators interviewed in the study generally felt that technology use was improving, but that it only significantly impacted student learning about technology, having little or no impact on learning in other academic content areas. Learners in Virginia generally were not getting enough access to technology in contexts that strengthened academic content areas.

This section presents survey ratings of how well students are being prepared to meet or exceed the Virginia Standards of Learning for Computers and Technology (SOL). This section also presents information on how technology use in Commonwealth schools has influenced students in the areas of:

- fluency in technology use
- strengthening the basics
- developing higher level skills
- increasing relevancy
- motivation to learn

FINDINGS

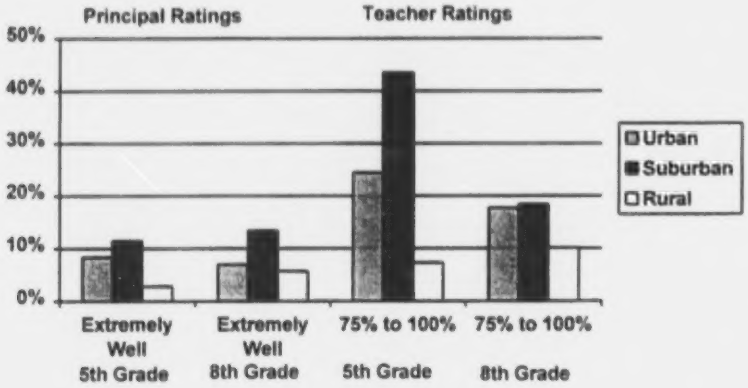
Just under half of school principals, when asked if 5th and 8th grade students in their schools were prepared to meet or exceed the Virginia SOLs for computers and technology, reported that they were. Eight percent to ten percent said they were "extremely well" prepared; 33 percent to 37 percent said they were "well" prepared.

More than 50% of principals did not feel students were adequately prepared. Forty-two percent said their students had done *some* classroom computer work but *not* enough to gain the skills necessary to meet the SOL goals. Seventeen percent of elementary school principals and 11 percent of middle school principals said their students were "not well" prepared meet the SOLs.

When *teachers* of 5th and 8th grade students were asked similar questions about what proportion of their students could meet or exceed the Virginia SOL for Computers/Technology, they gave a similar set of responses. About half felt their students were prepared.

Comparing these principal and teacher ratings within different regions of the Commonwealth of Virginia reveals that suburban educators are more likely to declare their students "extremely well" prepared" (75-100 percent proficient) for the Computers and Technology SOL. In particular, suburban students were rated twice as proficient as rural students.

Figure 9. Percent of Urban, Suburban, and Rural Principals and Teachers Giving the Highest Ratings for Student Computer/Technology SOL Proficiency



Survey researchers submit that these differences could be reflective of the greater social and economic advantages of many suburban communities. A negative correlation between the percent of students in schools qualifying for free school lunch and low SOL proficiency ratings given by the principals and teachers supports this interpretation. The negative correlation was somewhat stronger in the 5th grade than the 8th grade. More 5th graders than 8th graders in such schools were given lower proficiency ratings, perhaps because computer proficiency in 5th grade is more a result of home experiences with computers, an advantage not afforded students from lower socio-economic districts.

The perceptions reported here were validated by the results of recent statewide tests reported in October of 1998. Based on passing scores set by the Board of education, 72% of 5th and 63% of 8th graders met or exceeded the SOLs in Technology. (Source: Virginia Department of Education as reported by the *Washington Post* on November 3, 1998, p. B01.)

Table 6. Correlation of Principal and Teacher Ratings of Student Proficiency and Percent of Students in School Qualifying for Free Lunch

	Correlation with % Free Lunch
Principal Ratings of:	
5th Grade Proficiency	-.33
8th Grade Proficiency	-.25
5th and 8th Grade Teacher Ratings of:	
5th Grade Proficiency	-.46
8th Grade Proficiency	-.18

Fluency

Almost all principals (95 percent) and teachers (94 percent) said that using technology in the schools had improved the overall fluency of students. Forty-six percent of principals and 45 percent of teachers said students were "much improved" in their ability to use technology for a variety of educational purposes. Many students "grab hold" and learn to use computers for a variety of tasks. This is the area of greatest impact of technology use in schools.

Strengthening the basics

Principals and teachers in the survey were asked if students learn the academic basics—English, mathematics, science and history—with more depth through the use of technology. The principals and teachers gave very similar ratings and fewer than one in five felt technology had much improved student performance in any of the areas surveyed.

Focus group participants commented that technology, rather than being integrated into the total curriculum, was considered a separate content area. Furthermore, while the presence of technology in terms of "boxes and wires" was evident, its presence in the context of academic learning was less apparent. The types of student learning that *did* occur focused mainly on learning basic technology skills, such as keyboarding and word processing. Consensus among the teachers and administrators in the focus groups was that students can benefit from the proper use of technology, especially in terms of problem-solving, organization, research skills and taking responsibility for their own learning. Most participants, however, did not believe they were there yet,

> *I don't think we're integrating technology into instruction. We're using it more as remediation or for independent learning.*
>
> *—Teacher, Region 3*

Table 7. Principal and Teacher Ratings of Technology's Impact on Student Learning in Curriculum Areas

Area of Impact	Principal Ratings		Teacher Ratings	
	Much Improved	Somewhat Improved	Much Improved	Somewhat Improved
Knowledge in English	17%	66%	19%	53%
Overall level of academic achievement	14%	75%	18%	66%
Understanding the "basics" in the subjects you teach [a]	–	–	18%	52%
Knowledge in science	13%	63%	16%	54%
The *breadth* of students' under-standing of the subject(s) you teach [a]	–	–	15% [b]	55% [b]
Knowledge in history/social science	8%	63%	14%	52%
The *depth* of students' understanding of the subject(s) you teach [a]	–	–	13% [b]	55% [b]
Knowledge in mathematics	13%	69%	12%	60%

[a] *Question asked only on teacher survey*

[b] *Much Increased and Somewhat Increased*

Developing higher level skills.

During site visits to all levels of schools, many teachers observed that students had become increasingly sophisticated in their use of technology over the past three to four years. Students had gone beyond drill and practice into developing presentations, undertaking multimedia projects and conducting research with technology.

Seventy-six percent of teachers felt that technology had "much improved" or "somewhat improved" students' higher-level thinking skills in a number of areas. Principals were roughly equal or a little less positive in their ratings of technology's impact on students' problem solving and communication skills. (See Appendix A: Technical Report Survey Findings.)

While it is difficult to measure the extent to which technology has impacted student learning at this point, the ratings indicate that teachers and principals *believe* technology is offering many types of benefits to students.

Increasing relevancy

Virginia principals and teachers felt that appropriate technology use increases the relevance of students' learning experiences. Over three-fourths of them—82 percent of principals and 79 percent of teachers—said it increases the amount of choice students have in selecting projects and assignments. Similar proportions of teachers and principals said technology use allows and encourages students to increase the number of roles they assume in learning (e.g., trainer, publisher).

Survey researchers noted that in elementary schools, students were less likely to have a range of choices in activities involving technology. About one-in-five elementary-school principals (20 percent) and teachers (22 percent) felt that technology had "much increased" choices and roles for students, while one-in-three middle-and secondary-school principals (32 percent) and teachers (33 percent) thought so. There were no school-level differences on other items for this issue.

Table 8. Principal and Teacher Ratings of Technology's Impact on Increased Relevance of Student Learning Experiences

Area of Impact	**Principal Ratings**		**Teacher Ratings**	
	Much Improved	**Somewhat Improved**	**Much Improved**	**Somewhat Improved**
Higher-level skills (e.g. problem-solving, constructing knowledge)	17%	65%	20%	56%
Communicating and sharing ideas with others outside the school	20%	56% [b]	20% [b]	53% [b]
Ability to set their own pace for learning	14%	52%	19%	42%
Students' independence as learners [a]	–	–	18%	61%
Student engagement in inquiry-based learning projects [a]	–	–	18% [b]	61% [b]

[a] *Question asked only on teacher survey*

Anecdotal evidence by focus-group participants suggested cases in which computers *were* being used for higher-level thinking,

> A high school teacher described a lesson on different religions and asked the question "What was it like in 1940 compared to today?" She had the students use the Internet for research. Students imported data into word processing and spreadsheet programs. Using these data, they created graphs and pie charts.

Other teachers in the focus groups said they lacked the knowledge of how to use and integrate technology into the overall learning environment and therefore they continued to view it as separate from the curriculum.

Motivation to learn.

Motivation to learn is a key impact of technology. Data gathered on student performance related to computer use is inconclusive and observations by teachers within Virginia's schools that technology was leading to better academic performance were only anecdotal. However, many teachers noticed increased interest and motivation as a result of technology. Eighty-four percent of teachers said that student exposure to technology increased the number of assignments they turned in.

Our survey reveals that elementary-school teachers were more likely than middle- and high-school teachers to say the use of technology had much-improved their students' motivation to learn and go beyond minimal assignments. Nearly one of two elementary-school teachers (46 percent) said this, compared to about one-in-three middle (34 percent) and secondary school (34 percent) teachers.

Researchers found—through site visits—that student motivation most often correlated with teachers' comfort levels in using technology, ready access to technology in the classrooms, and adequate support within buildings and by school divisions. Students who had exposure to appropriate technology were exhibiting high levels of interest in content material mediated through technology and were engaging in technology-related classroom tasks with enthusiasm.

As noted, principals and teachers said using technology had only a minor impact on dropout rates, number of behavioral referrals, or school attendance. There was one exception. Twenty percent of urban school teachers reported that the use of technology had greatly increased student attendance on days when technology was scheduled to be used. Fewer than one-in-ten suburban (eight percent) or rural (nine percent) teachers reported a similar effect on their students. Given the needs of many urban schools, this is an important area of benefit.

A number of teachers interviewed in the site visits reported that the use of technology in *special education* classes had a particularly positive impact on student comprehension as well as engagement in academic tasks.

Table 9. Principal and Teacher Ratings of Technology's Impact on Student Motivation to Learn

Area of Impact	Principal Ratings		Teacher Ratings	
	Much Improved	Somewhat Improved	Much Improved	Somewhat Improved
Amount of choice students have in selecting projects/assignments for study	24%	58%	28%	51%
Student engagement in project-based activities [a]	–	–	27%	56%
Students' attentiveness/ engagement in class [a]	–	–	22%	46%
Number of roles students assume in learning (e.g., trainer, publisher	20%	63%	21%	59%
Amount of time students spend working with other students in their class/school [a]	–	–	16%	53%

[a] *Question asked only on teacher survey*

Focus group discussions regarding the *Learners* dimension resulted in the following recommendations to the state of Virginia:

- provide every teacher and administrator with the necessary tools to responsibly use various technology applications to prepare and evaluate students;
- provide a model for state expectations for technology in the elementary, middle and high school classrooms;
- be realistic and fair in your expectations about what educators can and cannot provide given existing resources, local contexts, and timelines.

TECHNOLOGY CAN HELP MOTIVATE STUDENTS TO READ

It is the perception of many teachers and principals that students seem more motivated to learn when they are actively engaged in tasks that require the use of technology. For example, at many elementary schools in the state, the *Accelerated Reader* software package is used to encourage students to read books. This software program has been facilitated by a group of publishers of children's trade books and its use does not require many computers. Students select books to read from a long list of books at different reading levels. Upon completion of a book, each student accesses a test, via the computer, to assess the student's comprehension of that specific book. In some schools, the student's score on the test determines a number of points earned, either individually or for a student team, and points may be used toward a prize. This program has stimulated students to read trade books for meaning and often garners support from the school's Parent-Teacher Organization as well as from teachers and principals.

LEARNING ENVIRONMENTS

Is the learning environment designed to achieve high academic performance by students through the alignment of standards, research-proven learning practices and contemporary technology?

As the Six-Year Educational Technology Plan for Virginia (1996-2002) recognizes, simply adding "boxes and wires" to public school classrooms is not enough. To be effective, a statewide commitment to technology must include an effort to create different and improved learning environments that combine good teaching practices with good learning practices.

When teachers are less conversant with technology, they tend to confine students' experiences to drill-and-practice and separate classes instead of integrating the technology throughout all academic content areas. Furthermore, while the Virginia SOLs are a core part of the learning context, educators are struggling with how to effectively use technology in teaching them. The site visits revealed that the most frequent uses of technology in Virginia schools were for: remediation; drill-and-practice; word processing; and vocational, business and special education classes. Activities that include Internet research, scientific simulations, group learning/problem solving, e-mail communication and Web page construction appeared to be used very little, and less at the high-school level than at the elementary- or middle-school levels.

RESULTS

Several focus group participants indicated that the state is emphasizing integrating technology throughout the curriculum, but its SOLs for technology are separate from the academic content SOLs and are tested separately. The participants asked for a more consistent approach that would embed the technology skills at appropriate points within the academic subjects.

> *It certainly would be a benefit to remove the technology SOLs. Technology should not be measured as a separate entity but should be examined in its integration into curriculum and administration. It seems counterproductive to set it apart as a separate tool.*
>
> *—Parent, Region 5*

Technology access.

Access to technology is the first issue to address when evaluating a school's technology learning environment. Teachers and students need access to productivity tools, online services, and media-based instructional materials. The physical placement of computers within schools and within classrooms is a major determinant of how easily collaborative group projects can be facilitated. Researchers noticed the computers in one elementary school classroom were so closely spaced that teachers found it difficult to fit small groups of student collaborators around them.

Statewide, teachers estimated that students in their classrooms spent about one-half of a class period per week, or 34 minutes, using computers for "any reason." Principals gave a higher estimate, indicating that students spent an average of about one class period per week, or 48 minutes, using computers for "any educational purpose." Teachers indicated that student computer use focused mostly on word processing and content-based drill-and-practice programs.

Students were less involved with other technologies such as videotapes and television, technology peripherals, other software programs, graphing calculators, and the Internet. Only infrequently—if at all—did students participate in interactive video for distance learning; work with lasers, robotics or related devices; or create Web pages for the Internet.

Patterns of technology access were often different for Virginia's elementary, middle, and secondary schools. Principals and teachers reported that elementary-school students spent more time per week using computers (51 minutes by principals; 41 minutes by teachers) than did middle- or secondary-school students (43 and 44 minutes by principals; 24 and 29 minutes by teachers). Elementary-school student use was usually limited to word processing and drill-and-practice, with less time spent on other kinds of applications with computers and technology.

Table 10. Principals' and Teachers' Estimates of Time Per Week a Typical Student in Their School/Classroom Uses Technology

Area of Student Activity	Principal Estimates in Minutes per Week				Teacher Estimates in Minutes per Week			
	0 -15	15-30	30-60	60+	0 -15	15-30	30-60	60+
Using computers for any educational purpose	6%	20%	41%	33%	30%	24%	25%	21%
Word processing [a]	–	–	–	–	49%	24%	17%	11%
Using content-specific programs for purpose of drill and practice [a]	–	–	–	–	50%	25%	15%	10%
Viewing videotapes or television in a non-interactive environment	32%	38%	25%	6%	61%	25%	11%	3%
Using technology peripherals for educational purposes (e.g., scanners, printers)	45%	28%	20%	8%	65%	19%	8%	7%
Using desktop publishing and/or graphics programs [a]	–	–	–	–	69%	14%	11%	6%
Using graphing and/or scientific calculators	57%	17%	15%	12%	74%	12%	6%	5%
Researching information on CD-ROM [a]	–	–	–	–	73%	17%	7%	3%
Researching information on the Internet [a]	–	–	–	–	74%	17%	8%	3%
Using computer simulations [a]	–	–	–	–	82%	9%	6%	3%
Managing databases [a]	–	–	–	–	87%	6%	4%	3%
Managing/analyzing spreadsheets [a]	–	–	–	–	89%	5%	3%	3%
Participating in an interactive video environment (e.g., for distance learning)	88%	7%	3%	2%	91%	6%	2%	1%
Working with lasers, robotics, remote sensors, etc.	90%	6%	3%	1%	94%	3%	2%	1%
Developing Web pages [a]	–	–	–	–	96%	2%	1%	1%

[a] Question asked only on teacher survey

The common barriers to increased use of computers in classrooms, as mentioned in the *site visits* conducted in October of 1998, were:

1) inadequate quantity and/or quality of equipment and software;

2) lack of adequate and timely technical assistance;

3) inadequate time for teachers to identify, learn and practice using the appropriate applications;

4) difficulty of accessing computers within schools;

5) network failures (often chronic);

6) inadequate access to the Internet;

7) too little professional development focusing on integrating technology into the curriculum.

Focus group discussions reflected this last point. Participants felt there was a lack of manpower necessary to create an "ideal" technology learning environment. It was concluded among focus group participants that while technology might be available in the schools and classrooms, a lack of understanding about how to manage and use technology keeps it from being integrated into daily instruction and learning. Furthermore, while the Virginia Standards of Learning (SOLs) are a core part of the learning context, educators are struggling with how to effectively use technology in teaching them.

Learning content

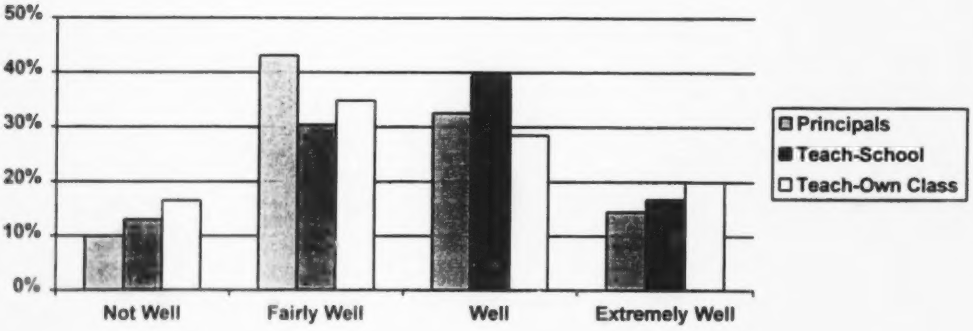
Technology should be integrated into the classroom curriculum, reinforcing academic standards and content, rather than being used as typing was taught in the past—as a separate subject unto itself. How well technology is integrated into learning within the schools is a key component of the *Learning Environments* dimension. When Commonwealth principals rated how well their schools had integrated technology into their own schools, forty-seven percent of principals marked "extremely well" or "well." The remaining principals said technology was integrated into learning only "fairly well or "not well."

Teachers who participated in the focus groups thought that the Virginia Department of Education should provide schools with the resources, materials and knowledge of how to use and integrate instructional technology into the curriculum,

> *The (Virginia Standards of Learning) provide the objectives to be reached by students at each level. What is missing is the direction of how to attain them with technology. For example, one SOL specifies that students will create projects with technology. Does the state assume we have LCD projectors and digital cameras to do this? We don't. How do they envision the SOLs to be accomplished?*
>
> *—Teacher, Region 4*

Teachers were a little more positive in their ratings about the integration of technology into the overall school, with fifty-seven percent marking "extremely well" or "well" integrated. When asked how well technology is integrated into learning in their *own* classrooms, teachers gave a wider range of answers than when rating the whole school; higher percentages rated the extremes – either "not well" (17 percent) or "extremely well" (20 percent) – when assessing their own integration of technology into learning. There were no differences between elementary, middle, or secondary schools or between urban, suburban, or rural schools on this question. Researchers observed through the site visits that teachers whose pedagogical approach already favored student-centered group work appeared more ready to integrate technology into the curriculum in meaningful ways, compared to teachers who didn't typically engage students in group work.

Figure 10. Principal and Teacher Ratings of How Well Technology is Integrated Into Learning in Their School (Teachers and Principals) and Own Classroom (Teachers Only)



Learning context and communication.

Research shows that effective technology use occurs in a learning context where it is a tool for researching issues, solving problems, and communicating results. One way of establishing this learning and communication context for technology use is for the teachers and other school staff to use technology as an integral part of their *own* work. This translates into time using computers to accomplish a range of work-related purposes:

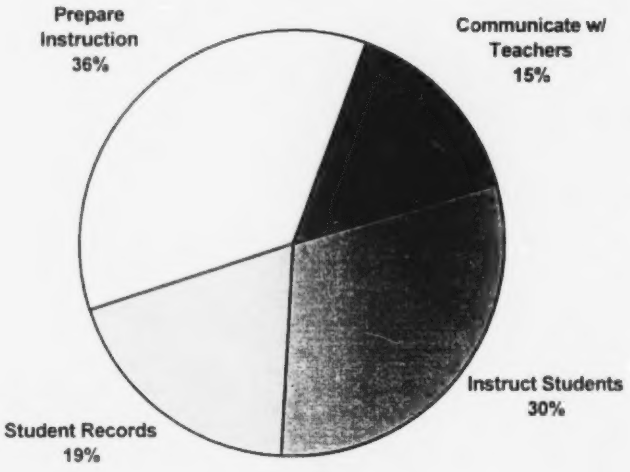
- Two-thirds of Virginia's principals answered that their teachers spend over an hour per week using computers for their own work;
- Eight percent of principals said their teachers spend less than 30 minutes per week using computers for their own work;

- More suburban teachers use computers than do their urban or rural counterparts. About seven in ten principals in suburban schools indicated that the typical teacher spends more than 60 minutes per week using a computer compared with about six in 10 principals in urban and rural schools;
- Middle and secondary school principals reported more computer use by teachers than did elementary principals.

When principals were asked for what purpose their teachers used technology, the most common answer was instructing students, closely followed by preparing for instruction, communicating with parents or colleagues, and recording student information. Elementary principals were somewhat more likely to report their teachers using computers for instruction, and less for student record keeping. Rural principals tended to report lower rates of computer use than suburban and urban principals.

We asked teachers to report what percentage of their technology use fell into various categories. Their answers reflected the same general pattern as the principals.' Preparing for instruction and instructing students occupied a slightly larger percentage of their time; working with student records and communicating with parents or colleagues inside or outside of the school involved a somewhat smaller percentage of their time.

Figure 11. Teacher Report of Percentage of Technology Use for Instructional Activities



The types of technology used were mostly word processing and basic computer applications like accessing the Internet. Table 11 lists a breakdown of teachers' activities per week. Very few teachers use computers to author Web pages for the Internet, use e-mail, or work with lasers, robotics, etc. In all of these activities, elementary-school teachers reported they used computers for less time than did middle- or secondary-school teachers.

Teacher participants in the focus groups commented that they were "ready to go" in terms of using technology, and many were using technology already, but were frustrated by the lack of appropriate and relevant technology training. The consensus was that teachers were becoming more comfortable with technology for their own productivity/management purposes, but they did not necessarily understand how to integrate it into the curriculum at high levels.

> *I think we are holding back kids if we don't do some of these higher level projects…teachers will tell kids to make a diorama or a poster, well why not a PowerPoint slide show? I think it is the comfort level of the teachers that holds kids back.*
>
> *—Teacher, Region 5*

Table 11. Teacher Estimates of Time Per Week They Spend Using Technology on the Following Activities

Area of Teacher Activity	Time Estimates in Minutes per Week			
	0 -15 min.	15-30 min.	30-60 min.	60+ min.
Word processing	7%	13%	21%	60%
Basic computer operations (including Internet applications)	10%	10%	21%	60%
Conducting research that contributes to lesson plans and curriculum design	34%	23%	23%	20%
Researching information on the Internet	37%	19%	20%	24%
Checking or reporting on student information	42%	22%	17%	20%
Communicating with colleagues inside and outside the school /division	43%	21%	18%	18%
Using desktop publishing and/or graphics programs	45%	18%	16%	22%
Developing instructional presentations	46%	19%	20%	15%
Researching information on CD-ROM	57%	22%	14%	7%
Managing/analyzing spreadsheets	59%	16%	14%	11%
Developing Web pages	92%	4%	2%	3%
Working with lasers, robotics, remote sensors, etc.	92%	3%	2%	3%
Using e-mail to communicate with parents	92%	5%	2%	2%
Using the Internet to provide the community with information about the classroom or school	94%	4%	1%	1%

School culture

Principals and teachers judged that there were several areas where technology had impacted school culture:

- improved ability/willingness to share ideas and skills with others (86 percent principals, 77 percent teachers);
- improved general staff morale (78 percent principals, 68 percent teachers); and
- improved efficiency or effectiveness of school management (90 percent principals, 66 percent teachers), and staff ability/willingness to share ideas and skills with others (84 percent).

Principals and teachers in urban and suburban communities tended to report more positive impacts on most questions regarding school culture than did principals in rural schools. Principals and teachers from elementary schools reported more positive impacts on relationships with parents and the community than were reported by middle and secondary schools.

Table 12. Principal and Teacher Ratings of Technology's Impact on School Culture

Area of Student Impact	Principal Ratings		Teacher Ratings	
	Much Improved	Somewhat Improved	Much Improved	Somewhat Improved
Ability/willingness to share ideas and skills with others	34%	52%	34%	43%
General morale	26%	52%	33%	35%
Efficiency or effectiveness of classroom management	43%	47%	29%	37%
Sense of empowerment to address school issues	14%	42%	14%	28%
Ability to work in teams to identify goals, make decisions, solve problems	17%	46%	14%	35%
Relationship with parents and the community	19%	58%	12%	31%

We asked questions about the impact of technology use on educators' own performance. Nine out of 10 teachers (91 percent) reported that technology use had increased the amount of materials and resources they used in their classes. Many teachers also reported making improvements in the overall quality of their instruction, increasing the breadth of instructional strategies they used, and other curriculum changes.

Middle- and secondary-school teachers were more likely to say that they had "much-increased" their performance in each of these areas than elementary-school teachers. Computer use seems to result in more changes to middle- and secondary-school instruction than it does to elementary-level instruction. Survey researchers submit that the difference may be due to elementary teachers having introduced technology some time ago, and may have already incorporated it into their curriculum. Also, the use of technology at elementary levels involves simpler and fewer applications and may therefore be easier to integrate into the curriculum.

Table 13. Teacher Ratings of Technology's Impact on Their Behavior

Area of Instructional Impact	**Teacher Ratings**	
	Much Increased	**Somewhat Increased**
The amount of materials and resources you use in your class(es)	40%	51%
Overall quality of instruction you deliver	33% [a]	54% [a]
Your repertoire of instructional strategies	28%	58%
The number of changes you've made in the curriculum	25%	57%
Your participation in instructional planning at the department or school level	17%	42%

[a] *Much Improved and Somewhat Improved*

Focus Group participants made the following recommendations to the state about the *Learning Environments* dimension:

- Give us the time we need to meet and "work these things out," i.e. how to use technology in meeting the SOLs;
- Provide appropriate resources required to achieve the SOLs, including curriculum and lesson plans developed by the state that educators can use in their classrooms;
- Always have at the forefront and basis of any plan that technology is not a luxury skill but a life skill. Each student leaving the schools—from McDonald's worker to mechanic, from doctor to secretary—will need to be proficient with technology.

TECHNOLOGY MAKES POSSIBLE NEW TYPES OF PROJECTS

At one middle school visited for this report, teachers are designing interdisciplinary, thematic units that utilize technology. In math class, for example, students collect scientific data about streams and rivers and enter it into databases as they work in the field. After returning to the classroom, students analyze the data, develop graphs, make comparisons, conduct further research via the Internet, write reports and make presentations. A teacher who is comfortable using technology and a student-centered collaborative approach to teaching and learning is more likely to effectively integrate technology into the curriculum for student projects.

PROFESSIONAL COMPETENCY

Are educators fluent with technology and do they use technology to the learning advantage of students?

> *Kids seem better able to handle technology than the teachers and that makes teachers uncomfortable. If a teacher is afraid of the technology, to handle it, then she'll be afraid that kids will be running amok.*
>
> *—VETAC member*

Training of professional staff is a necessary component of successful implementation of technology in education. For this section we asked principals and teachers to rate the adequacy of teacher training for using technology in education as well as teacher proficiency on the Technology Standards for Instructional Personnel that have been adopted by the state. We then delved into ways in which schools or divisions have emphasized teacher training for integrating technology into instructional practices, with the understanding that such an emphasis is the first step to actual integration of technology into instructional practices.

> *Management is the biggest issue. How do you experiment with technology activities you have never done before and keep the classroom running smoothly?*
>
> *—Teacher, Region 7*

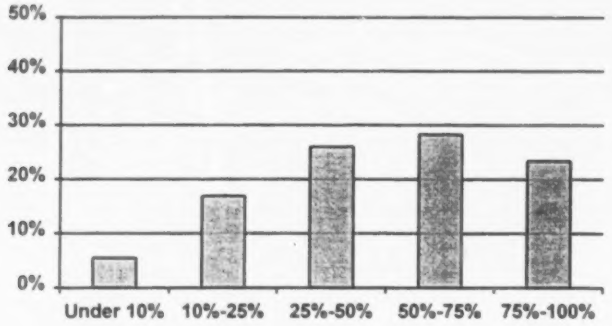
Core technology fluency

Teacher preparedness begins with teacher training. When reflecting on how well teacher preparation institutions were training teachers to use technology in education, over one-third of principals (35 percent) and teachers (44 percent) felt that the institutions were training teachers "extremely well" or "well". About one-third felt the institutions were preparing them "fairly well" (40 percent principals, 34 percent teachers); and about one-fourth felt the institutions were doing "not well at all" (25 percent principals, 23 percent teachers). These ratings were consistent across urban, suburban and rural schools and levels.

The site visits reflect that although large numbers of teachers are still at the stage of acquiring *basic* knowledge and skills for computer use, a growing number are developing their competence in adapting classroom technology so that it becomes an integral component of student learning and curricular change.

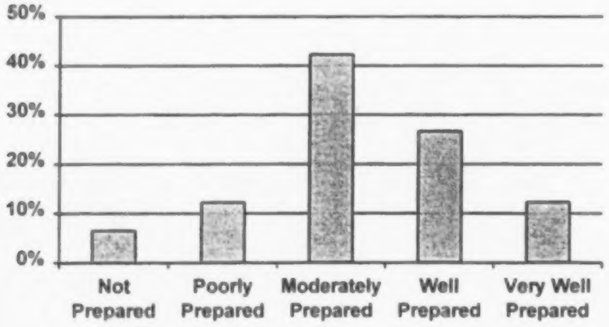
Principals were then asked to go beyond rating the institutions that train their teachers and indicate what proportion of their teachers met the Technology Standards for Instructional Personnel. About one-half of the principals felt that the majority of their faculty met the standards. Proportions across all categories are displayed in Figure 14.

Figure 12. Principal Estimates of Percentages of Teachers Who Meet or Exceed the Virginia Technology Standards for Instructional Personnel



On a similar item teachers were asked how well prepared they were to use technology in instruction. Just under four-in-ten said they were "very well" or "well prepared"; another four in ten said they were "moderately prepared". About two in ten said they were "poorly prepared" or "not prepared" to use technology in instruction. Examining these findings across level of school and location of school, we found no significant differences.

Figure 13. Teacher Self-Evaluation of How Well Prepared They Are for Using Technology in Instruction



In every school division visited, teachers were making major efforts to increase their knowledge and skills in the use of technology. Nevertheless, teachers cited several barriers limiting their ability to achieve increased proficiency in technology. Although some school divisions were helping to subsidize technology training costs, many teachers indicated they must use their own resources and their own time to increase their professional competency. The lack of time and funds to do so where cited as the major barriers teachers face.

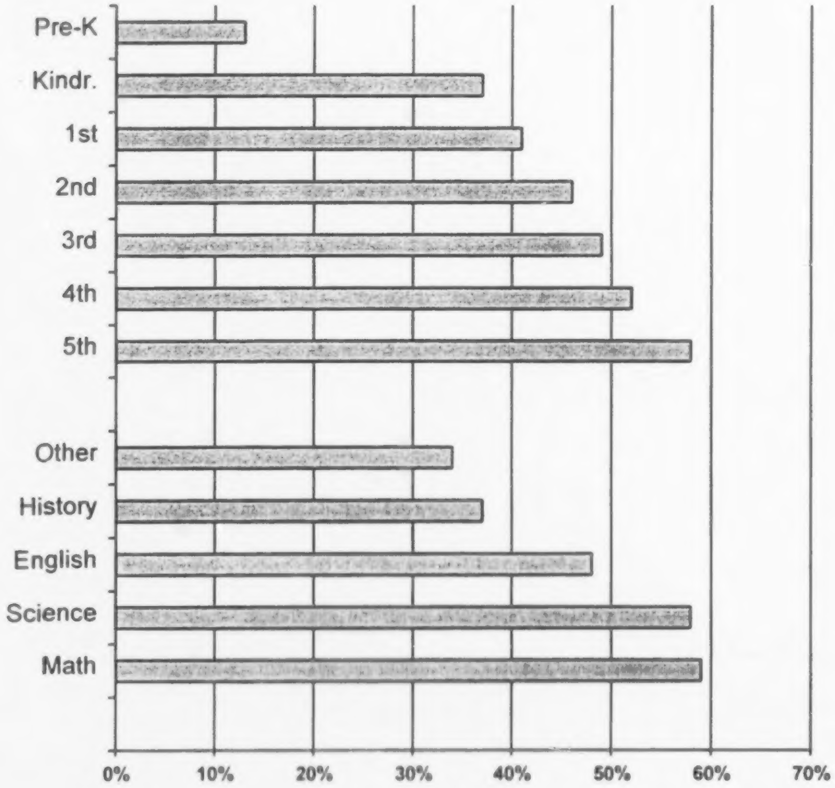
One teacher in region 4 expressed in the focus group, *"I think teachers are coming on board more and more. It's just a matter of time. I would prefer that the training take place during certification of teachers..."*

Teachers expressed that they needed time to learn about applications, practice new skills, observe other teachers, talk with colleagues, and learn how to manage a new set of resources (including how best to organize classrooms for students to use technology effectively).

We asked the principals at which grade levels and in which subjects they felt the majority of teachers were proficient in the Technology Standards for Instructional Personnel (Figure 14). More than half of the grade school principals indicated that the majority of their first through fifth grade teachers were proficient. While principals reported a lower level of teacher proficiency in grades pre-kindergarten and kindergarten, survey researchers submit that this may reflect a perceived lesser need for teacher proficiency in the lower grades.

In middle and secondary schools, we grouped teachers across subjects. Over two-thirds of the principals indicated that the majority of their math and science teachers were proficient, while that percent dropped to around half for English and history teachers.

Figure 14. Percent of Principals Stating a Majority of Teachers are Proficient



Researchers report the findings thus far suggest *some* teacher training institutions are doing an adequate job in training teachers to use technology, while others are seriously deficient. This is most evident in the 25 to 50 percent of principals who do not feel that their faculties are proficient in the skills outlined by the technology standards.

Curriculum, instruction, and classroom management

The survey also investigated division- or school-based technology training, specific to curriculum, instruction, and classroom management.

We asked principals and teachers what emphasis was given to several areas of technology training in their schools (see Table 14). They indicated that the greatest emphasis was on basic computer operations and curriculum use of technology to create learning opportunities for students. Principals were a little more likely than teachers to indicate that technology-training opportunities had been emphasized in the school during the past year.

Table 14. Principal and Teacher Ratings of Emphasis on Technology Training in Their Schools

Area of Training	Principal Ratings		Teacher Ratings	
	Substantial Emphasis	Moderate Emphasis	Very Much	(Moderate Emphasis)
Basic computer operations (including Internet applications)	54%	34%	38%	37%
Curriculum and instructional applications of technology use[a]	–	–	26%	38%
Using technology to create unique learning opportunities for students	39%	40%	25%	37%
Using technology to create educational contexts in which students take on a more independent role in their learning	26%	37%	17%	35%
Using technology to participate in professional networks and advance your own practice	25%	34%	12%	28%
Advanced telecommunications, such as creating a Web page or setting up distance-learning opportunities[a]	–	–	8%	18%

[a] *Question asked only on teacher survey*

We also addressed training in using technology to affect classroom management. We asked if there was emphasis on training in the use of technology for students to take a more independent role in their own learning. A majority of principals (79 percent) and teachers (52 percent) indicated moderate to substantial emphasis.

On the principal survey—but not the teacher survey—there was a tendency for suburban schools to be more highly rated in emphasizing training in all areas surveyed. This seems to be a continuation of the pattern of suburban schools advancing the use of technology in the curriculum faster than rural and urban schools.

Professional practice and collegiality.

Finally, technology can create opportunities for teachers to develop professional collegiality as well as advance their own practices. When fluency and resources allow access to email and the Internet, opportunities for professional interaction with colleagues and an abundance of resources become available. When asked what emphasis has been placed on training teachers to use technology in this way, twenty-five percent of principals and twelve percent of teachers indicated substantial emphasis had been placed on training in this area (see Table 14.)

The main point of discussion in focus groups was on the lack of funding for appropriate teacher training. Several participants mentioned that the state should put money into teacher training almost before it funded more equipment. One teacher explained that often after teachers have been exposed to "state of the art" instructional software and hardware in training workshops, they return to their schools to find older models of computers that cannot support the latest applications.

One teacher explained that often after teachers have been exposed to "state of the art" instructional software and hardware in training workshops, they return to their schools to find older models of computers that cannot support the latest applications.

Among the observations made in Region One's focus group, the instructional specialist said that the district receives approximately $100,000 from the state each year for technology, but that only $5,000 of that money can be used to train teachers. "You can't train 2,000 teachers with $5,000," commented the instructional specialist. She went on to estimate that about one-half of the equipment in schools went untouched because teachers didn't know how to use it.

Focus-group recommendations for the *Professional Competency* dimension included:

- Provide money to all localities for equal statewide teacher training and staff development so teachers are more comfortable using computers with students in their classrooms;
- Provide for adequate teacher training. One obvious way to help with this would be to require each school have an in-house, full-time technology specialist who could instruct teachers and students simultaneously, give teacher groups inservice, and provide individual teacher training on an as-needed basis.
- Provide a laptop computer for each Virginia educator at no cost to the local system in order for teachers to increase their skill levels on computers so they might effectively instruct students.

GOOD PRACTICES IN TEACHER PROFESSIONAL DEVELOPMENT: TEACHERS TRAINING TEACHERS

One effective model of teacher professional development in technology involved on-site peer instruction. In one school, an outside expert came to train some of the teachers who then went on to train the other teachers. Although the classes were not mandatory, these training sessions were usually filled to the capacity of standing room only. Teachers have become so technologically adept that they now have a list of "experts" within the school who can assist with certain software programs. The faculty continues to hold impromptu training sessions, and they also have demonstrations at faculty meetings for new teachers in order to acquaint them with instructional uses of technology in the school.

SYSTEM CAPACITY

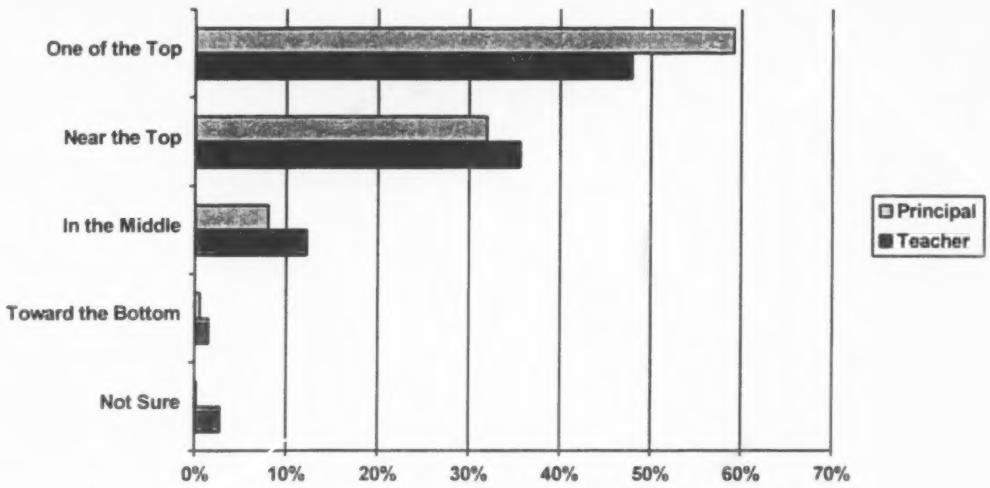
Is the education system reengineering itself to systematically meet the needs of learners in this knowledge-based, global society?

The educational system includes legal, organizational, and social elements that extend from the legislative policy level to the classroom level. The educational system defines roles for every participant in the system; articulates the goals that the participants should be seeking to achieve; and, ideally, provides the means by which participants can fulfill their roles and achieve their goals. Many commentators on educational reform have noted that our existing educational system was designed to meet the needs of agrarian and/or industrial economies, while we are now living in the age of information. This section asks, *"Is the Virginia education system reengineering itself to meet the needs of learners in this knowledge-based, global society?"*

Vision

A systemic approach to technology in the public schools in Virginia requires that the system engage key stakeholders and the broader community in defining and clearly stating their vision and expectations for technology in the schools. In general, results from the surveys of principals and teachers in Virginia indicate that these stakeholders support technology as an important priority for the public schools. As illustrated in Figure 15, when Virginia's principals were asked how important it was to provide public schools with access to computers, 95 percent of principals and 84 percent of teachers rated computer access as "one of the top priorities" or "near the top of the list of priorities" for public schools. Support was most intense among principals, with 59 percent of them rating technology as "one of the top priorities," compared to 48 percent of teachers.

Figure 15. Principal and Teacher Ratings of the Priority of Providing Public Schools with Access to Computers



It is also important to consider how principal and teacher support for technology may compare to support among the broader community. In a national survey of 810 registered voters who were asked the same question about computer access, results were as follows:

Table 15. Registered Voter Ratings of the Priority of Providing Public Schools with Access to Computers

Priority Level	Voter Level
One of the top priorities	26%
Near the top of the list of priorities	34%
In the middle of the list of priorities	31%
Toward the bottom of the list of priorities	8%
Not sure	1%

Source: Public opinion poll by Peter Hart Research Associates, commissioned by the Milken Exchange in June 1998.

Based on these results, it appears that teachers and principals in Virginia may have more favorable views of technology in the schools than the above-mentioned voters.

The survey finding that educators in Virginia support technology in the schools was echoed in the focus groups. Overall, respondents across focus groups recognized the potential of technology in learning. At the very minimum, they recognized that technology is not a "fad," and they asked the state to acknowledge the enduring nature of technology in the schools by providing continuous support and funding.

Defining the vision

One of the first—and most important—steps in producing systemic change is creating a vision of desired outcomes. In defining such a vision, stakeholders ask, "What would it be like if technology were effectively and broadly used in public schools?" Such a vision should describe a story of effective use and desirable outcomes. It should also include a cognitive, rational analysis outlining the steps required to produce such outcomes, or, "how to get from here to there."

Although the State has taken several steps to articulate a vision for technology in its public schools, including the *Six-Year Educational Technology Plan for Virginia*, site visit and focus group data indicate that many educators do not have a clear view of the State's vision. For instance, participants in focus groups were asked to specify what they believed to be the State's vision for technology in education. Across all groups, participants were hard-pressed to articulate a vision as communicated by the state. Most participants were unaware of the *Six-Year Plan*. Some identified the State's technology "mission" as the computer/technology SOLs and the teacher technology proficiency standards. Others disagreed. As one principal noted, "While the SOLs represent high minimum standards, they are not a vision for the future." One teacher suggested that, "People on the technology committees know the mission, but people who are out of the loop do not."

Data from the site visits also indicates that there is a lack of clarity among staff, teachers, and administrators about the State's vision for technology and how to put it into action. Across the different sites, using technology for educational purposes means different things to different people. Sometimes, technology was viewed as a set of requirements for students to meet (e.g., learning to use PowerPoint). Sometimes, technology was viewed largely as a way to track students' progress on Standards of Learning (SOLs) and to provide drill-and-practice as needed. And sometimes teachers saw technology as a way of changing curriculum and instruction in more fundamental ways, i.e., by allowing students to become more independent learners.

Equity

Finally, in discussing the vision for technology statewide, all focus groups—from the resource-wealthy to the resource-poor divisions—talked about the need for the state to ensure equity in the distribution of technology funds and resources. Indeed, the disparity in technology-relevant resources across divisions was evident during the site visits. School divisions demonstrated a large disparity in per-pupil funding for technology. In some divisions, the state's investment has been extremely important, because few other resources have been invested in technology. In others, the division's own contributions have been far larger than the state's. As a result, the technology infrastructure and support systems vary greatly across divisions. In several school divisions, spending on technology is at the level of $1,000 per student over a three-to-five-year period, which far exceeds the amount allocated by the state. At the other extreme, some school divisions appear to allocate less than $100 per student for a comparable period.

Focus-group participants made several recommendations to the state regarding the issue of equity. For example, one teacher urged that in funding technology, the state should make it clear to the divisions that state funds are *supplemental* and should not supplant local funds. Another teacher suggested that the state needs to ensure a *basic technology infrastructure* for every school and leave it up to the divisions if they want to move beyond that. A principal suggested that although schools need to start learning to use what they have available now, it would be helpful if the state provided guidelines or a basic framework of the minimum technology each school should have.

One participant provided a detailed written suggestion, "The state needs to change the funding formula in order to address inequalities of distribution and access, including elimination of the L-estimator as the method of calculating SOQ costs and the addition of capital outlay to the distribution equation."

Alignment and planning

The effective use of technology in Virginia's classrooms cannot evolve without the support of the entire system. Specifically, policies and practices of the system must be aligned with the state's vision for education technology.

Standards of Learning

Focus-group discussions of how to create learning environments in which technology is integrated focused heavily on integrating technology across the Standards of Learning (SOLs). According to focus-group participants, teachers focus so much on the SOLs that they may not use technology unless it is specifically mentioned within a Standard. Participants felt they needed more direction from the state regarding how to use technology to achieve the SOLs. Specifically, they thought the Virginia Department of Education should provide schools with resources, materials, and training on how to use instructional technology and how to integrate it into the curriculum

> *Saying that the SOLs are a "shared responsibility" is a rather nebulous term...there needs to be some coordination. If you don't have the equipment, it is just another situation where the state has mandated without providing the financial resources to fulfill the mandate.*
>
> *—A Region 4 principal*

Several participants observed that the state emphasizes integrating technology throughout the curriculum, but has established separate SOLs for technology and is testing them separately. Participants asked for a more consistent approach that would embed the technology skills into the core subjects at appropriate points and also include assessments of the embedded technology standards as part of the core-subject tests.

Local Technology Plans

The Virginia Department of Education has fostered technology planning among its school divisions by requiring them to complete a technology plan and submit it to the DOE. All school divisions have complied with this requirement. However, the school division is only one level of the local educational system; school-level planning for technology is also essential.

Survey results show that most, but not all, schools have developed their own technology plans. We asked principals if their *schools* had school-level technology plans: three-fourths (76 percent) said "yes". The urban and suburban schools are more likely to have technology plans than are their rural counterparts (79 percent urban, 80 percent suburban, 67 percent rural).

Results of the principals' survey also indicate that most schools (89 percent) do have written policies for students regarding the appropriate use of technology. Suburban schools were a little more likely to have established boundaries for student use of technology—94 percent, compared to 84 percent for urban schools. Rural schools fell in between them at 87 percent. In addition, three-fourths of the schools (72 percent) have written policies for teachers that delineate appropriate use of equipment and software.

Incentives for Professional Use

In addition to providing members of the educational system with adequate resources to accomplish the state's technology goals (see "Ensuring Capacity" below), the educational system should also provide educators with incentives for achieving these goals. Moreover, different types of incentives may convey different messages to educators about the system's vision for education technology. For instance, changing schedules to allow for greater collaborative planning among faculty may be very helpful in facilitating a transformed teaching process.

When principals were asked what incentives their schools or divisions have used to encourage teachers to use technology as part of their instructional activities, the most commonly selected answers involved implementation of what appear to be low-cost or regular programs for technology expenditures. Most encouragement came in the form of expectations or requirements of teachers (65 percent), use of school technology over the summer (65 percent), and resources for the media centers and classrooms (63 percent). Least-used options included technology certification for training (30 percent), schedule changes to allow for collaborative planning among faculty (30 percent), and salary incentives (eight percent). Responses from teachers followed the same pattern.

More elementary and middle than secondary principals reported that teachers could use computers and other resources over the summer as an incentive to promote technology (68 percent elementary, 67 percent middle, 56 percent secondary). Also used as incentives, particularly in elementary and middle schools, were special purchasing programs (49 percent elementary, 47 percent middle, 39 percent secondary) and schedule changes so that staff could collaborate for instruction and activities (32 percent elementary, 40 percent middle, 18 percent secondary).

Suburban and urban staffs are more likely than their rural counterparts to receive the use of school technology over the summer as an incentive for integrating technology (69 percent suburban, 67 percent urban, 59 percent rural). Suburban principals are more likely than either urban or rural principals to do the following to encourage their staffs in the use of technology: express high expectations for use or require it (71 percent suburban, 59 percent urban, 62 percent rural); give funding for resources in classrooms and media centers (59 percent suburban, 45 percent urban, 49 percent rural); and give release time for planning (38 percent suburban, 32 percent urban, 26 percent rural).

Table 16. Incentives Used by Schools and Divisions to Encourage Use of Technology

Incentives	Principal Report	Teacher Report
Technology-related resources approved for media centers and classrooms	65%	75%
Expectation/requirement that professional staff use technology as a research and learning tool	65%	72%
Use of school technology over the summer months	63%	63%
Funding for classroom-based and media center technology resources	52%	59%
Special purchasing programs for computers/technology	46%	56%
Access to a technology-based administrative system for efficiencies	39%	40%
Technology certification for teachers who are trained in technology	30%	34%
Acknowledgment of effective teacher use of technology	39%	29%
Release time for planning the use of technology	32%	23%
Schedule changes so teachers have time to learn and plan collaboratively	30%	23%
Salary incentives for teachers seeking technology training	8%	8%

Middle and high school teachers are more likely to have software for keeping student records. Schedules that allow staff to collaborate on instruction are more common in elementary and middle schools than they are in high school, according to both principals and teachers. Teacher responses indicate that there is also a difference according to school location. Urban staffs reported the most collaboration time; rural staffs the least.

Ensuring capacity

Barriers Within the System

Information gathered from educators during the site visits and the focus groups emphasizes that the need for more technicians to maintain the hardware and networks in each school or school division is paralleled by an equally critical need to have instructional support staff in the schools to assist teachers in using technology for appropriate and significant learning activities for students.

Consistent with the site-visit findings, focus group participants also identified time and scheduling as key barriers to training. Several teachers suggested that the state "keeps giving but doesn't take anything away." Even with adequate training, teachers understood the time and planning commitment required to integrate technology. One remarked, "I need planning time to sit down and see what it is and what I can do with it." They suggested that "leadership" (e.g., principals, superintendents) needed to understand and buy into the use of technology before that kind of planning time was made available.

The Need for Sustained State Funding

Eighty percent of surveyed principals and more than half (54 percent) of the teachers felt that the state is spending too little money on technology for instructional purposes. Although to a somewhat lesser degree—perhaps because of being less familiar with the specifics of school needs for computer funding—this perception of under-funded school technology is shared by 50 percent of (in a national sample) registered voters, 49 percent of a cross section of high-level business executives, and 42 percent of state legislators and top legislative staff who are members of the Education or Appropriations committees in their respective states.

When we asked how well state and local funding together could provide adequate funding to implement the school's technology plans, one-fourth of the principals (28 percent) answered "extremely well" or "well." Most principals said the combined funds would provide for their program only "fairly well" (43 percent) or "not well" (29 percent).

Site visits also supported the idea that public schools need more funding for technology. According to site-visitor reports, many schools make good use of older computers, but cannot upgrade them, or the corresponding software, due to lack of funds.

One focus group participant clearly articulated her view on why the state, rather than the local education agency, should provide more funds for technology,

> *If you're going to give a mandate for completion of a standard that teachers as well as students should uphold, it is also necessary for you to have the resources provided in those school systems where it is lacking.*
>
> *—Teacher, Region 3*

In addition to asserting the need for more technology funding from the State, focus group participants emphasized the importance of sustained funding. While most participants felt that the state had done an adequate job of helping schools acquire technology, they feared funds would be cut off before schools were fully equipped or teachers provided with opportunities to learn meaningful ways of integrating technology in the learning environment. As one focus group participant wrote, "Just providing funds for one year doesn't satisfy keeping current with the technology."

Priorities for State Funding

The need for funding for staff development was strongly asserted in the focus groups and site visits. Although focus group participants thought that the State's plan for providing technology and related equipment to schools was on the right track, they stated that the training of teachers in using the technology was severely under-funded:

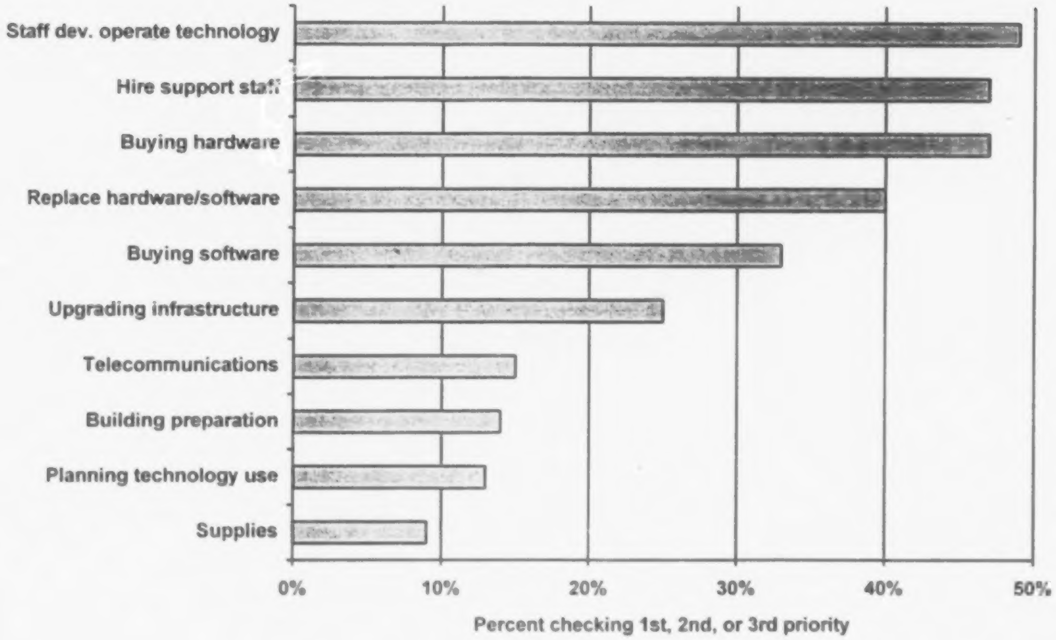
> *The instructional specialist indicated that the district receives approximately $100,000 each year for technology from the state but that only $5,000 of that could be used for training teachers. Said the division's instructional specialist: "You can't train 2,000 teachers with $5,000." She went on to estimate that about one-half of the equipment in schools went unused because teachers didn't know how to use it.*
>
> *—Facilitator Notes: Region 1*

Several focus group members suggested that the state should put more money into teacher training, perhaps even before it funded more equipment. While teachers reported participating in several different types of professional development, including conferences, classes at community colleges, classes provided by the division and by the State, and training by vendors, the consensus was that technology training was best done locally, on an as-needed basis:

> *If the state would provide the funds for in-service training on technology, then each division could determine its own way to make it successful.*
>
> *—Media Specialist, Region 5*

Survey results support the focus group and site visit finding that educators believe that technology-related staff development should be one of the State's highest priorities for additional funding.

Figure 16. Top Three Priorities for Additional Technology Funding (Principal Survey)



There were no significant differences in survey results between groups regarding training staff for technology; one-half of all principals gave training a high priority. Urban principals were most likely to give importance to professional development for effective use (63 percent urban, 47 percent suburban, 38 percent rural).

According to survey results, hiring technology support staff was a higher priority with suburban schools, perhaps because they are further along in adoption or are more likely to afford it (34 percent urban, 57 percent suburban, 44 percent rural). Elementary school principals gave a higher priority to hiring staff for technological support than did secondary principals (51 percent elementary, 39 percent middle, 46 percent secondary). As mentioned below, elementary school teachers rate themselves as having fewer computer skills than do their secondary school counterparts.

Another difference between groups in these responses is related to hardware purchases. A few more urban school principals (54 percent) gave hardware purchases a high priority for any possible spending than did principals in suburban (44 percent) or rural (45 percent) schools.

Most, but *not all*, of the school buildings in the State, in terms of basic systems such as power, ventilation, and security, are apparently adequate for technology setups. An average of 14 percent of principals at any grade level indicated that their buildings needed basic improvements. The buildings that do need basic systems updating are mostly urban (23 percent), followed by rural (16 percent), and suburban (8 percent).

Updating buildings for technology with wiring, lighting and installing networks is a priority for many schools in the state. Such changes in the infrastructure of the building are much more in demand for inner-city schools (39 percent gave these changes a high priority) than they are for rural schools (25 percent) or, as would be expected, for suburban schools (17 percent). There is little difference between grade levels regarding the priority for wiring and other upgrades—about one in four gave such changes a high priority regardless of grade level (26 percent to 22 percent).

Telecommunications are a budgeting priority for only 15 percent of all principals. They were more often mentioned as a spending priority by rural school principals than they were by either urban or suburban school principals (22 percent rural, 15 percent urban, nine percent suburban). Priority rankings were similar between grade levels. As discussed below, only half of the schools have telecommunications available to them.

Leadership and Systems Thinking

In many of the schools visited, strong school and division leadership was identified as critical to the effective implementation and use of technology. Having "champions" at the division level (e.g., superintendents, technology coordinators, technical support staff) and school level (e.g., on-site technology directors, teachers, media specialists, principals) was seen as vital to the successful use of technology for instruction. In one school, teachers spoke of the foresight of the principal and his leadership in transitioning the school into the technology magnet. One teacher stated, "He empowered the teachers and got their input…he formed the technology committee and started the first training…"

A site visit case example of an elementary school where strong leadership made a difference follows:

"Nine years ago in this rural district, there was only a handful of Radio Shack TRS 80s and a few Commodores in *all* the schools put together. Now, with the assistance of state and district funding, the elementary school brought Internet access to both the school computer lab and to almost every classroom. Students begin using computers for reading instruction in kindergarten. Older students exchange e-mail correspondence with students at a school in Australia. Teachers began using computers to track attendance five years ago; for the past two years they have used computers for grade reporting.

The school leadership believes in infusing technology into all aspects of the school environment, and the district has a strong commitment to staff development and training. It has increased teacher training in the use of technology, especially over the last three years. Technology coordinators are extraordinary in their ability to acquire old hardware and upgrade it for the schools in the district.

For all these reasons, a small rural school in Virginia is rapidly moving into the 21st century. The school obviously benefits from visionary leadership by the superintendent, district office, technology coordinators, lab personnel and the principal.

—Site-visit technical report

Community Connections

Is the school community relationship one of trust and respect, and is this translating in mutually beneficial, sustainable partnerships in the area of learning technology?

Schools have great needs due to the expense of technology, especially in comparison to the educational materials of yesteryear. Schools and communities can work independently of each other in building their technology bases—and often do—but this can change if schools begin to see themselves as "community centers." Citizens of all ages understand that technology is important and want children to be educated for the workplace and leadership roles of tomorrow. Some parents and other citizens would like to be involved in policy decisions in their local schools, including those regarding technology. Companies have offered equipment and supplies; citizens have volunteered to teach, tutor, and help with equipment. On the receiving end, some adults want technology training for themselves and access to equipment that is convenient and inexpensive, both of which the schools can offer.

Technology can also create connections by making communication between communities and schools easier, in the form of e-mail and on-line access. Technology provides incentives for more involvement, as both schools and communities need and vie for limited resources.

RESULTS

Virginia is in the very early stages of change in their school-community relationships, having interest in—but minimal links with—the local community regarding educational technology. There is evidence of a few schools looking beyond the walls of their buildings to resources in the community—for funding, equipment, software, materials, and personnel with the skills and willingness to be involved in the schools. In some districts, the local community approved special bond issues or tax levies, which provided a dramatic infusion of funds to schools to support technology purchases.

In one case, teachers and students were able to access the computer lab facilities of the local university. In another, researchers discovered a program for which the initiative came from the business community in the form of increased support for technological training in the schools.

Focus group participants discussed the need for effective networks that could connect communities to the schools as a resource. Such networking would provide professional communication among educators just as other industries have, and most important, eliminate the "information deficit" for students living in remote or resource-poor areas.

Commitment

We did not find, through the data collection, an overall commitment to establishing the kinds of connections described above.

Despite the mutual needs of schools and communities, developing a strong relationship between the two requires a lot of effort. A significant finding by the researchers was that most principals—58 percent—said that their communities *did* play a role in planning for the school's technology program.

Most evidence of community involvement came from people who were already involved in schools, however. Site-visit researchers found Parent-Teacher Associations to be the most common community relationship. Links with local businesses, city governments, universities and other institutions were much less common.

Elementary and suburban schools had the most parental involvement. Whether using the rating of "very involved" or "moderately involved", elementary schools' numbers show significantly more involvement from parent, teacher, or student organizations than do secondary schools or middle schools.

Parental involvement in suburban schools seems to be related to economics. Parents who had higher degrees and more success in school themselves are more prepared and more likely to find a place for themselves in the schools.

High schools tend to have the lowest parental involvement, but garner support from other sectors. Local post-secondary institutions are noticeably more involved in secondary schools than they are in middle schools or in elementary schools (Table 17). They are also more involved in schools located in urban and rural areas.

Few schools stated that business groups were "very involved". The average for all grade levels was 12 percent. But secondary schools were more likely to have higher rates of "moderate involvement" than elementary and middle schools (moderate involvement: 35 percent elementary, 34 percent middle, 46 percent secondary). Principals were generally more positive in their ratings of parental involvement than teachers.

Table 17. Involvement of Community Groups in Technology Use by School Level

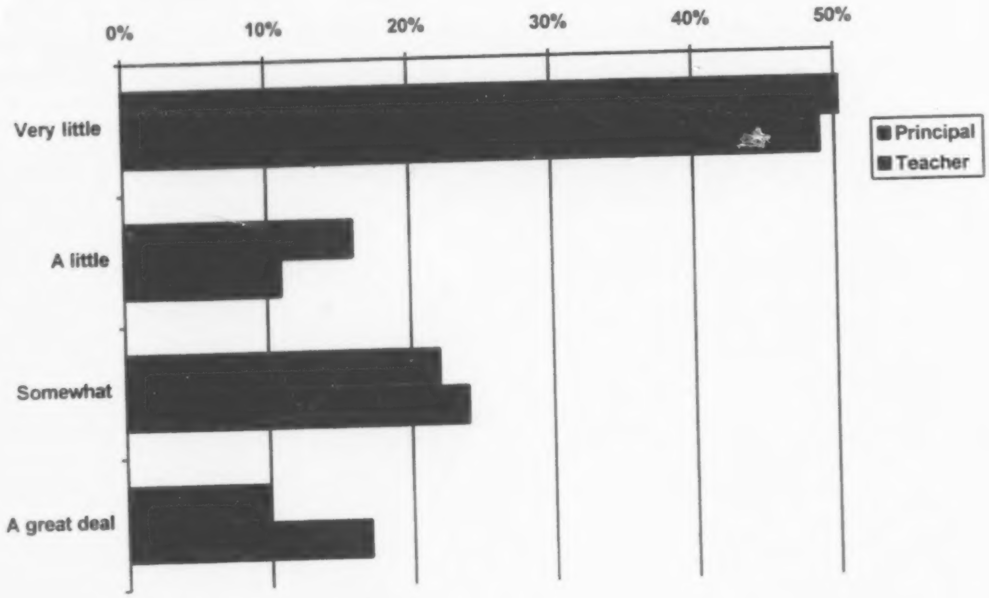
Groups	Total State	Level of School			School Community Type		
		Elem.	**Mid.**	**Sec.**	**Urban**	**Suburb**	**Rural**
Principals							
Parent, teacher, or student organizations	65%	72%	65%	44%	61%	73%	58%
Business groups	36%	33%	38%	46%	35%	35%	38%
Local post-secondary institutions	23%	18%	25%	41%	18%	16%	35%
Teachers							
Parent, teacher, or student organizations	64%	65%	49%	45%	49%	65%	49%
Business groups	35%	35%	34%	46%	35%	41%	36%
Local post-secondary institutions	22%	16%	28%	42%	21%	26%	33%

Collaboration

We asked principals to report *what* role their communities played in shaping their schools' vision for technology. There were no differences between grade in these reports, the communities were involved in all of them alike. Suburban schools were a little more likely to report community involvement (65 percent) than urban (52 percent) or rural (54 percent). One-third of the principals (33 percent) said that the community's part was minor, and only nine percent said that the community had no involvement.

The schools surveyed were not very likely to see themselves on the giving end, i.e. contributing either technology resources or services to their communities. There were no differences between locations for this issue. However, secondary schools were nearly twice as likely to say they donated to the communities as the elementary schools.

Figure 17. The Extent to Which Schools Offer Their Communities Technology-based Resources and Services.



Technology Capacity

Are there adequate technology, networks, electronic resources and support to meet the education system's learning goals?

There are many components to the successful use of technology in education. Key staff members must sign on, faculty and staff acquire appropriate training, and technology use must be woven into the entire curriculum. These are issues already discussed in this report. But these preparations can be for naught if the hardware capacity to use technology is not established. This includes having buildings that are technology ready, (e.g., available space, adequate power, available Internet wiring), hardware and software which is accessible to teachers, and technical support staff.

At one middle school visited, five years ago there were only six computers in the whole school; today there are 155 and they are used daily in instruction. In social studies, for example, students create Web pages and use Hyperstudio to create projects. Similarly, at one high school, five years ago there were only 75 computers that were not solely dedicated to business classes; now, the corresponding figure is 350. Some classrooms are equipped with five computers, there are several computer labs, and *all* of the computers have Internet access.

But although the number of computers in *some* schools is high, many schools visited had as few as *one* computer in each classroom. Teachers commented that this shortfall limits the extent to which computers can be appropriately integrated into instruction.

One site visit to a wealthy, suburban middle school revealed that there were several computers, but virtually none available for classroom instruction. They were clustered in labs and teachers had to schedule time for students to use them.

Focus group participants generally agreed that there was a substantial amount of technology available in schools, but the essentials to its use, such as training and technical assistance, were not there yet. They suggested a wish list for the "ideal" technology program:

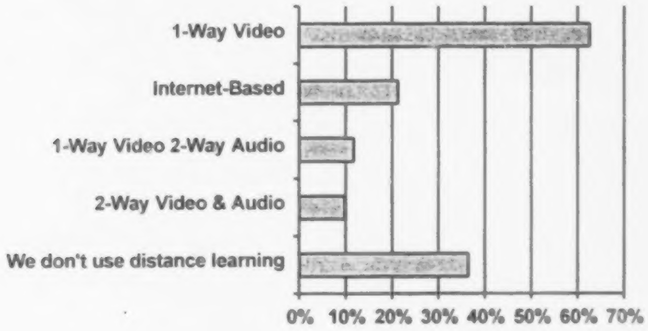
> *Depending on its size and needs, the school would have from one to three full-time support personnel provided by the state: one instructional technology specialist to assist teachers in integrating technology; one network engineer to keep LAN and WAN networks functioning and to make sure every classroom had working access to the Internet; and one technical person to troubleshoot and maintain equipment. Each teacher would have a laptop provided by the state, and would have to show proficiency and use. Other technologies such as TVs and VCRs would be readily available in every classroom.*
>
> *—Facilitator Notes, Region 3*

Installed base.

Principals surveyed were asked to rate how suitable their buildings were for the installation of appropriate instructional technology (e.g., space for computers, ease of wiring, lighting, ventilation, security). Sixty-one percent of principals rated their schools as suitable; 39 percent rated them "somewhat suitable" or "not suitable". Not surprising, more suburban (68 percent) than rural (57 percent) principals rated their schools as suitable. As on many other measures, suburban schools appear to have more adequately funded and implemented technology programs.

From here, principals were asked how capable their schools were of receiving and/or transmitting live or delayed instruction from a distance. Nearly two-thirds (63 percent) reported one-way video and audio capabilities (cable television, satellite dish). Fewer than one-in-five reported capabilities for Internet-based distance learning. Nearly 40 percent reported that no distance learning was used in their school.

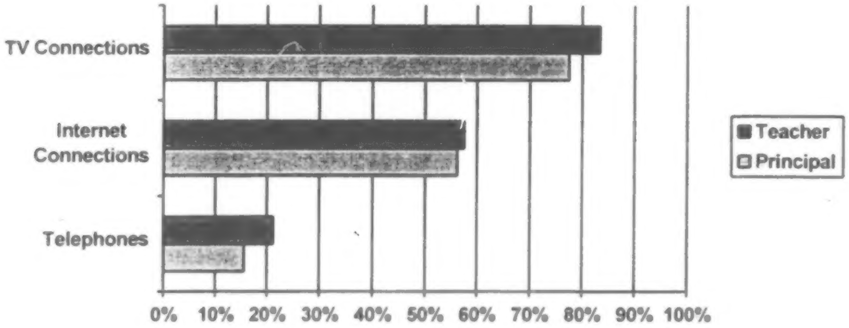
Figure 18. Percent of Distance Learning Technologies in Schools (Principal Survey)



Classroom and other instructional rooms.

Principals and teachers were asked what percent of classrooms and other instructional rooms used telephones, computers connected to the Internet, and TV monitors with cable or antenna feeds (Figure 19). Television connections were the most prevalent. Far fewer classrooms had telephones available than had Internet access.

Figure 19. Percent of Classrooms with Telephones, Internet Connections, and TV Connections



The survey of principals revealed substantial differences between urban, suburban and rural schools' connections to the Internet. Suburban principals reported about three-fourths of their classrooms (75 percent) and other instructional rooms (73 percent) were connected to the Internet. Urban and rural principals reported 36 and 46 percent, respectively, for classrooms; 48 and 52 percent for other instructional rooms.

Reports from the site visits revealed a range of Internet access in schools. For example, one rural elementary school serving a high-poverty population has Internet access in nearly every classroom. Other schools have almost *no* access, such as a suburban high school serving over 1800 students in which students have access to only three computers with Internet connections.

Connectivity of workstations.

Principals and teachers were asked to list the number of computers in various locations of their buildings (classrooms, computer labs, media centers, and administrative/counseling offices). They were also asked how many of these computers were connected to the Internet, either by modem or high-speed network.

On average, principals reported that half the computers in their schools were connected to the Internet; teachers reported that half of the computers in their classrooms were connected. Computers in media centers and administrative and counseling offices were far more likely to be connected to the Internet (about 90 percent) than those in classrooms.

Based on the above numbers and the availability of computers, researchers calculated the number of students per computer in each area of the school. Virginia schools have an average of 12.5 students per modern computer. A modern computer was defined as a PC 486 or Mac LCIII or better. These are computers capable of running up-to-date applications for learning and teaching. For this reason, state and division goals for providing access to computers might more usefully be stated in terms of the ratio of students to modern computers, and not just students to any type of computer.

There are about 11 students per multimedia computer or computer connected to a local area network within the school. For every computer capable of accessing the Internet there is an average of ten students in school who have access to it. When all types of computers are considered—modern, early-generation PC and Apple—there are about five students per computer.

The most accessible location for computers in Commonwealth schools is in the classroom. The average number of classroom computers as reported by teachers was 4.1 machines per room. Fifty-five percent of teachers said they had access at school to a computer in the classroom or office at school.

Table 18. Mean Number of Students per Computer by Location (Principal Survey)

Type of Computer	Mean Number of Students per Computer			
	Computer Lab	Class	Media Center	All School Areas
Modern Computer (PC—486 or better or Mac—LCIII or better)	20.1	13.8	68.8	12.5
Multimedia Computer	30.3	20.2	105.4	10.9
Computer connected to a Local Area Network	29.0	20.4	96.9	10.7
Computer connected to the Internet by modem or high speed line	30.0	19.1	56.2	9.7
Total of all instructional computers	15.2	10.0	55.3	5.4

Concentrations of computers were also revealed by the survey results:

- Elementary schools tend to have a greater percentage of computers located in classrooms while middle and secondary schools have them in computer labs;
- In elementary schools over one-half (59 percent) of the computers are in classrooms and less than one-third (29 percent) of the computers are in labs;
- In middle schools the ratios are nearly even (45 percent class, 44 percent lab); and
- About one-tenth of all computers (12 percent elementary, 11 percent middle, 12 percent secondary) are in the media center.
- Also, elementary schools tended to have fewer computers connected to local area networks (46 percent elementary, 52 percent middle, 65 percent secondary) and lower connection rates to the Internet than the higher grades (24 percent median elementary, 42 percent median middle, 30 percent median secondary).

Availability of additional equipment.

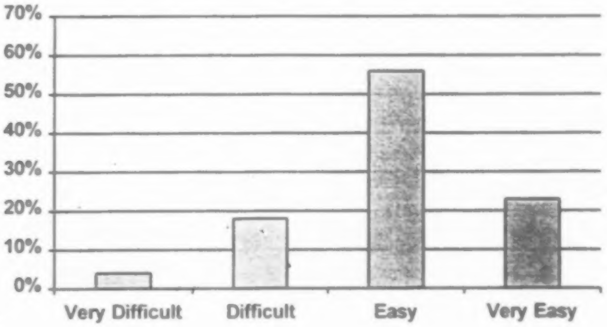
Availability of additional technology equipment was surveyed. Equipment available in more than one-half of the schools included color or laser printers (90 percent principals, 79 percent teachers), scanners/digitizers (80 percent principals, 58 percent teachers), video cameras, editing suite (79 percent principals, 62 percent teachers), and digital cameras (74 percent principals, 48 percent teachers).

Site visits revealed further kinds of technologies available to students, including satellite receivers, distance learning stations, Channel One, telephones in each classroom, large-screen TV-monitor combinations, LCD panel displays, computer projectors, laser disc players, graphing calculators, etc. Suburban schools tended to have greater quantities of additional technology equipment than either rural schools or urban schools. Scanner/digitizers, for example, were more available in suburban schools than urban or rural (87 percent suburban, 76 percent urban, 74 percent rural.)

For level of school, a consistent pattern emerged. Equipment was significantly more available to the middle and secondary schools surveyed than the elementary schools. Given the advanced nature of much of this equipment, this finding is not surprising.

We asked teachers how well defined the procedure is in their school for accessing media center or computer lab equipment. Almost all said it was very well defined (54 percent) or moderately well defined (37 percent). We also asked teachers how easy it is, in general, to access the technology they need in their schools. Teachers were somewhat less positive in answering this question, with nearly one in five (22 percent) saying it was "difficult" or "very difficult" (Figure 20).

Figure 20. Teacher Ratings of How Easy it is to Access Technology in Their Schools



Technical support.

One of the biggest challenges to the successful use of technology in Virginia schools is the lack of technical support. General consensus was that there is inadequate support to provide timely expert troubleshooting, technical assistance, ongoing maintenance, operations and upgrades. For example, while many of the schools represented in the focus groups had computer labs, few had staff available to assist teachers and students on a daily basis. Consequently, the labs were under-used by teachers who had limited computer skills. As one library specialist indicated, "Two to three weeks is too long to wait (for technical assistance)!"

Site visits revealed similar findings. As one librarian in a poor rural school commented, "We lost our school technology specialist last year and it wasn't until March that another person was hired."

Principals were asked several items about the technical support available to teachers. For an overall picture, 56 percent reported having a staff member who provided at least 8 hours a weeks to supporting teachers' use of instructional technology. Teachers in the focus groups indicated that this amount of time was not sufficient,

> *It's a time problem. No amount of money will provide you with the time you need to do it. Plus, I'm not always available—often I'm in my own classroom when other teachers need me. We need a full-time computer educator, not just a hardware repairman*
>
> *—Teacher and Technology Rep., Region 4*

Stark but predictable differences emerged across both location of school and level of school. For location, significantly more suburban principals than both urban and rural reported having a staff member who provided technical support (71 percent suburban, 55 percent urban, and 38 percent rural.) For level of school, significantly fewer elementary school principals than both middle and secondary school principals reported having technical support in their school (55 percent elementary, 66 percent middle, 62 percent secondary).

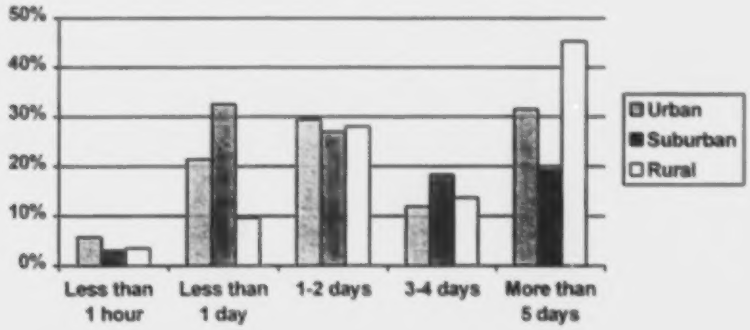
We also asked principals about the availability of division-level support specialists for hardware, software, and network problems. The highest level of support was for hardware and networking and somewhat less for software use. As seen before, significantly more suburban and urban principals reported receiving all kinds of division support than rural. On this question, urban schools did not differ significantly from suburban schools.

Table 19. Sources of Technical Support (Principal Survey)

Source of Support	Percent Checking Each Option		
	Hardware	Network	Software
Division-level specialist	88%	84%	75%
School-level support specialist	57%	50%	60%
Technical help-desk	39%	37%	33%
Online e-mail or Web-based support	34%	37%	32%
Online end-user training	11%	13%	14%

When teachers were asked how long it typically took to get assistance when technology broke down in their classroom, about one-quarter (27 percent) said one day or less and another one-quarter (28 percent) said one to two days. As with other resource-intensive technology issues, suburban schools were more likely to report faster levels of technology assistance than rural schools, and to a lesser degree urban schools, as indicated in Figure 21.

Figure 21. Teacher Ratings of How Long it Takes to Get Technical Support



The outcome of the focus-group sessions was the following recommendations to the state regarding *Technology Capacity*:

- "Remember that not all school districts are the same size, have the same resources available, or are in need of the same technology. I think all schools are trying to meet the technology standards addressed by the Commonwealth with a limited amount of dollars."

- "Provide ongoing long-term funding for schools for training, maintaining, and upgrading technology. The funding should be in the form of price reductions for the newest technology available. The price reductions should be available for instructional personnel as well. The funding for training could be available in the form of simple and clear renewable grants."

- "When providing support to school districts and divisions, please consider all aspects of its intended purpose. Purchasing hardware and software needs to be supported by a human infrastructure of technical assistance, repair and training."

7 Accountability

Is there agreement on what success with technology looks like?

Are there measures in place to track progress and report results?

In order to effectively address the issue of accountability, the education system must first agree about what success with technology looks like. What are the outcomes that should be measured? Once these outcomes are identified, the system must develop measures to track progress and report results. At the same time, it is fair to say that measuring the benefits of technology, especially in regards to student achievement, is a difficult undertaking that challenges every state and school district.

Deliverables and benchmarks.

At the beginning of any program, desired outcomes should be outlined that include student development in several dimensions, including skills and attitudes. Through this process, outcomes become an integral part of the planning, development, implementation and evaluation of a program.

Focus group and site-visit reports indicate that the computer/technology Standards of Learning (SOLs) and the technology standards for instructional personnel are viewed by educators as the primary technology benchmarks that are employed statewide.

Site-visit reports indicate that technology standards for instructional personnel are widely accepted by educators. Principals and teachers seem to believe that these standards are "here to stay" and make sense. Many teachers are participating in professional development to learn more about technology, sometimes with the support of their school division. For example, one division is focusing this year on helping teachers meet Standards 1, 2, and 8.

In terms of the computer/technology SOLs for students, site-visit and focus-group data indicate mixed opinions among educators. Many principals and teachers accept the standards as reasonable, although some believe the standards may be set too high. The biggest concern, evident at a number of sites visited, appears to be that schools will be held accountable for student competencies that the schools are not in a good position to teach. In one poor, agricultural county, for example, there has not yet been much, if any, emphasis on teaching students to use spreadsheets or to design Web pages. The schools currently lack hardware and software that would enable them to teach these skills.

In the focus groups, many teachers felt they were being held accountable for the technology SOLs when they often (a) did not have the resources to teach them and (b) did not know the content of the state tests. While most participants were supportive of the technology SOLs, there was concern about the lack of integration with the other academic areas and the fact they are tested at only the 5th and 8th grade levels. There was consensus among many of the participants that much of the responsibility for teaching the skills and knowledge required by the state tends to fall on the shoulders of the 5th and 8th grade teachers. Simply put, they felt all of the content could not be covered in these grades alone. Teachers expressed a need for a clear and systematic plan that specifies the scope and sequence of what to teach at each grade level. (Note that these criticisms and suggested solutions were not limited to the technology standards, but rather applied to all content areas covered by the SOLs).

Another criticism of the technology SOLs identified in the focus groups was that the test be used to measure students' technological competencies emphasized technical vocabulary ("bits and bytes") at the expense of relevant technical skills. Some participants also questioned the appropriateness of using a paper-and-pencil test for assessing the technology SOLs. Additionally, the educators questioned the fact that the technology standards end at the eighth grade; educators were concerned that in the absence of technology-related standards, high school students would not continue to learn necessary technology competencies.

As previously mentioned, the overall consensus in focus groups was that educators need time to learn to integrate technology; to understand how and when to use technology; to become technology literate; and to explore and develop a learning environment that integrates technology in meaningful ways *before* they can be held accountable for student technology outcomes.

Data Collection and Communication with Stakeholders

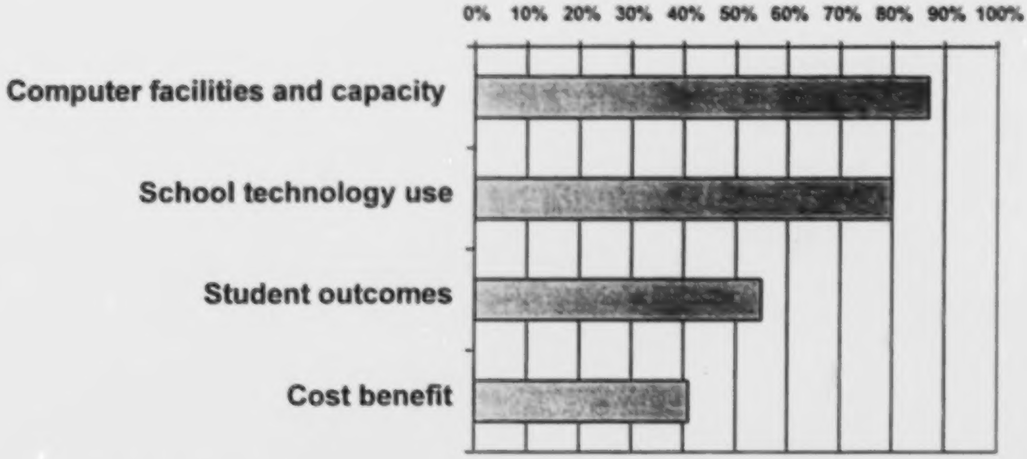
Along with its usefulness in program design and development, accountability is naturally expected after big outlays of financial support. Funding agencies want to know what they got in return for their investment; other audiences also want to know what was gained from expended effort and opportunity costs. In the case of funding technology in the schools, accountability has been addressed in the past through providing lists of equipment, software, supplies, and numbers of hookups to the Internet and local area networks.

However, in the '90s and beyond, investors—in the form of the public and state agencies—want to look beyond the purchases to the end-result of their investment. They want to know the difference such investments have made in the activities and experiences of students, and the technological training students have acquired in the process. Study results indicate that in Virginia (and the vast majority, if not all, of the other states), valid and ongoing means for assessing these types of outcomes throughout the state education system have not been developed or implemented.

In this study, most of the principals said that their schools or divisions provided a great deal of information to the local school board or community regarding the status of technology. Most principals (87 percent) said that their schools or divisions gave inventory information regarding computer facilities and capacity. A large majority (80 percent) said that they gave qualitative information in the form of reports on program innovations, progress, and problems. There were no meaningful differences on these issues based on locale or grade level.

Student outcome or cost-related information was less often cited as being available to school boards or the public. This may reflect the fact that such information is not always required; the collection of this type of data also takes more effort, expertise, and time to assemble. Still, about one-half of the principals (55 percent) said that they have given information regarding student outcomes associated with technology to local school boards and communities. Fewer principals (41 percent) said that they have provided cost-benefit information. Other parts of this study indicate, however, that these principals' answers most likely refer to what constitutes the first steps of a cost-benefit analysis rather than a true cost-benefit analysis.

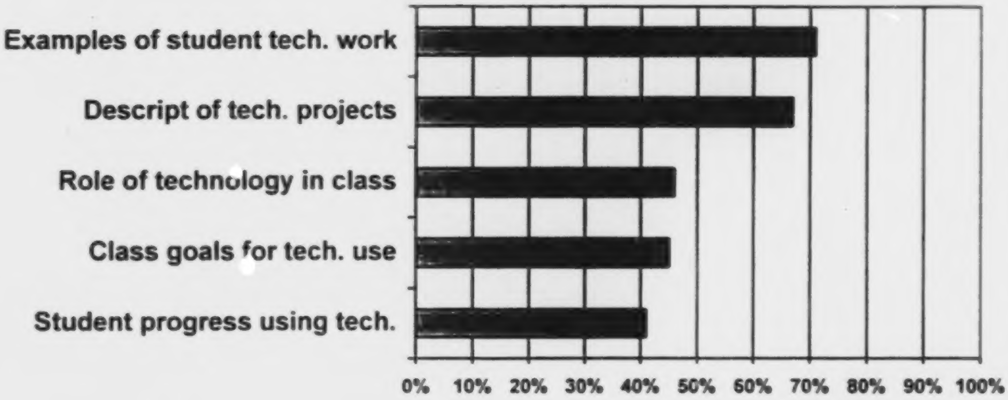
Figure 22. Type of Technology Use Information Reported to Local Board and Community (Principal Survey)



While many principals said that they had given their school boards and/or communities information regarding technology access and use in their schools, most of them did not receive useful feedback as a result. Not quite one in four (23 percent) said that they had received "a great deal" of feedback which could be incorporated into their schools' technology plans. One-third of them did say that they were given "some" feedback, and one in four (27 percent) said that they had received little or no such feedback. This data revealed no differences between groups in terms of metropolitan status or grade level.

We asked teachers about their reporting of technology-related information to parents. Most teachers said that they gave parents examples of student computer work (71 percent) and descriptions of projects that used technology (67 percent). Fewer teachers explained the role that technology plays in their classrooms (46 percent) or a list of classroom goals for technology use (45 percent). It is interesting that fewer than half of the teachers (41 percent) gave parents some kind of progress report regarding student skills and use of technology. It is apparently not part of a routine report, at least not statewide.

Figure 23. Type of Technology Use Information Reported to Parents (Teacher Survey)



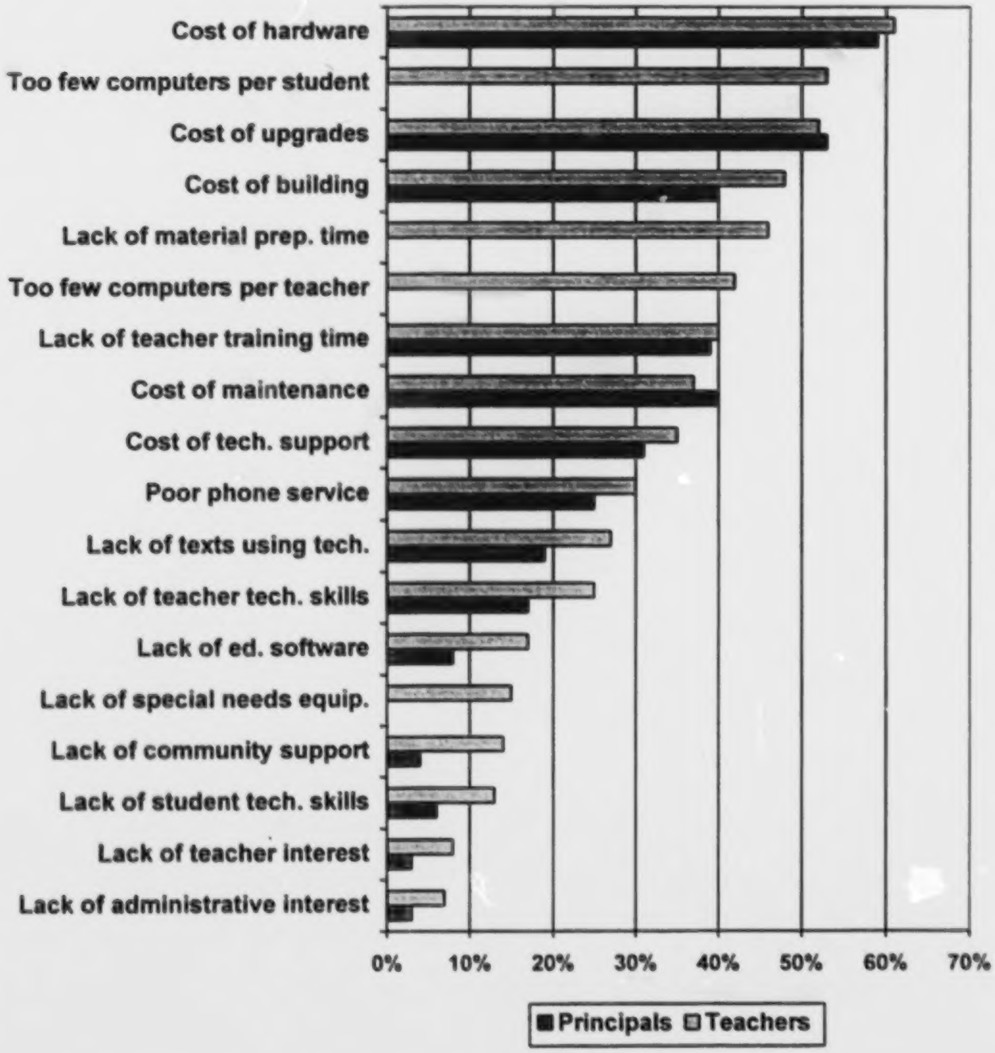
Data-driven decision making

Accountability encourages awareness of program development and the process by which a program is implemented. When outcomes are not as impressive as had been hoped, knowing where and why things went wrong can help guide program reform. When outcomes imply that a program has been successful, there are many reasons to want to know what made a difference: to replicate the success in other programs; to continue support of the pieces that made a difference; to confirm that yes, indeed, the efforts expended were justifiable and worthwhile. In either case, knowledge of significant barriers to success is an important part of planning program adjustments or implementing other programs altogether.

In terms of technology, the barriers noted as being "significant" by Virginia principals are primarily financial. (Indeed, even bargain technology is far more expensive than the educational materials of yesteryear.) The costs of hardware are significant, and half of the teachers (53 percent) said that having too few computers available for students is a major problem for them. Fewer, but still many, teachers (42 percent) said that they themselves need more computer availability for their own tasks. The costs of upgrades, building preparation, and maintenance have had an impact on 40 percent to 50 percent of the principals and teachers.

Tangentially connected with money is lack of time for training teachers to use computers and technology (40 percent principals, 39 percent teachers). Elementary schools have a more difficult time finding time to train staff, but this is not surprising, since, among other things, they have a greater need for training and less negotiable time during the day. Almost half of the teachers (46 percent) also said that lack of time to prepare instructional materials for technology is a problem.

Figure 24. School-Level Barriers to Increased Use of Educational Technologies



As discussed previously, focus group discussions and site visit reports emphasized that teachers and principals feel strongly that Virginia's public schools need more funding for technology. However, the focus groups and site visits placed greater emphasis upon the lack of funding for technology-related *staff development* than one might expect based upon survey results. In fact, some focus group participants felt strongly that funding for additional hardware purchases would not be worthwhile until teachers gained the competencies that would be required to use the hardware.

When we analyzed survey data by subgroup, suburban principals were less likely to mention financial concerns across the board, no doubt because of their greater tax base. Rural principals were less likely to say that teacher training or providing support staff for technology was a significant barrier. This may indicate, when considered in light of other responses on the survey, that rural schools have been slower getting started with technology so they are not far enough along into the process for as many principals to realize a need for such support.

Most respondents did *not* say that lack of support from any segment of their community—teachers, administrators, board members, or community members—holds them back. One out of every five respondents indicated that the lack of textbooks integrated with technology is a big problem; elementary principals were especially likely to note the problem (21 percent elementary, 13 percent middle, 14 percent secondary). This is a reflection of the fact that elementary grades have fewer technological materials—especially curriculum materials—available to them, especially on lower reading levels.

Methodology

Survey of School Principals or Designees and School Teachers

The RFP laid out specific steps and tasks to be undertaken in developing, fielding, and analyzing survey data from school principals (or designees) and school teachers across Virginia. The following tasks were completed:

- Development of a survey plan to meet study goals for a written survey of school principals or principal designees and school teachers.

  The initial study task was to write an instrument plan specifying which issues were to be addressed in the surveys as well as what information principals and teachers were to be asked to provide for each issue. The survey plan explicitly identified how the questions principals and teachers were asked provided the information request in the RFP for Component 1, Section A, Points one through nine:

  1. Extent of student and teacher use of technology for instruction;
  2. Student technology-related outcomes;
  3. Availability of technology for instructional use;
  4. Availability of technical support;
  5. Inclusion of technology in the curriculum;
  6. Teachers preparation and professional development to use technology;
  7. Barriers to greater availability and use of technology for instruction;
  8. Adequacy of technology funding; and
  9. School leadership support for effective technology use.

- Development of draft and final survey forms from current literature and from discussions with Virginia DOE personnel and their designees.

  Consortium evaluators met with Virginia Department of Education (DOE) personnel and their designees both in person and by other means, to review preliminary survey plans (described above) and to draft survey instruments. The purpose of these interactions: to identify specific recommendations for survey items or issues to emphasize. Draft copies of the principal and teacher survey forms were delivered for review to the Virginia DOE. (Samples of the survey instruments and cover letters can be found in Appendix E.)

Pilot test of the surveys

Consortium evaluators conducted a pilot test of the draft survey instruments with a sample of Virginia principals and teachers. The pilot test focused primarily on issues of completeness, clarity, and absence of bias in wording. The evaluators asked principals and teachers to complete the surveys, then in follow-up telephone interviews, to discuss how meaningful, clear, complete, and unbiased they felt individual items and the overall survey were. A total of 20 principals and teachers participated in the pilot test, with about even numbers from elementary and secondary level schools.

Surveyed school principals or designees in all public schools in the Commonwealth of Virginia, as well as a statistically validated random sample of school teachers

Principal Survey. The study's scope specified that a census be taken of all 1,880 public school principals regarding their schools' use of technology for instruction. To begin this, we designated Commonwealth schools according to region of the state (*urban*, *suburban* or *rural*) and according to type of school (*elementary*, *middle*, *secondary* or *other*). Table 20 below shows the distribution of Virginia schools by these categories. "Other" schools included alternative (N = 60); combined (N = 48); special education (N = 36); and vocational (N = 38).

Table 20. Number of Virginia Public Schools Available to Survey

	Urban	Suburban	Rural	**Total**
Elementary	308	490	349	1,147
Middle	78	117	81	276
Secondary	56	97	122	275
Other	47	68	67	182
Total	489	772	619	1,880

Initially, the proposed survey design specified that we use a multi-phase sampling design to survey the schools. First we planned to sample some 600 schools for intensive recruitment *and* follow-up activities, then do less-intensive follow-up activities with the remainder of the 1,880 schools. And that is how we began.

However, we obtained an exceptionally high response rate (87 percent) from both the intensive and general survey groups of principals, so we decided to treat responses to both samples of schools as one group. The study design also allowed for telephone interviews with non-responding principals, but the very high response rate made this step unnecessary.

Teacher Survey. The RFP specified that a statistically valid random sample survey of school teachers be conducted to: (a) represent teachers throughout the state; and (b) allow comparisons of teacher responses from different levels (elementary, middle, and secondary) and locations (rural, suburban, and urban). For middle and secondary school levels, a comparison of mathematics, science, history, and English content areas was to be included. Our sampling strategy accomplished this goal by surveying teachers from a stratified random sample of 300 schools. Of the 300 schools surveyed in this study, 91 percent (273 schools) had all or almost all of the teachers return surveys.

Table 21. Stratified Sample of Schools Used in Teacher Survey

	Urban	Suburban	Rural	**Total**
Elementary	25	38	31	94
Middle	32	41	34	107
Secondary	30	36	29	101
Total	93	115	94	302

Table 22. Rate by School for Teacher Surveys Completed/Returned

	Urban	Suburban	Rural	**Total**
Elementary	88%	89%	94%	90%
Middle	88%	93%	97%	93%
Secondary	83%	89%	93%	88%
Total	86%	90%	95%	90%

At the elementary grade level, three teachers were selected from each school for the survey. We stratified the teachers into three groups of grade levels taught (K-2, 3-4, 5-6), and asked the principals to randomly select those to participate in the survey. (See proposal for a description of the procedure principals used to select teachers.) If a school served grades other than K-6, then we made adjustments in identifying which teachers to survey. By following this plan, a total of 300 elementary grade teachers were to be surveyed.

At the middle and secondary levels, we selected five teachers from each school for the survey. We had principals randomly select teachers from strata defined by what topics they primarily teach: *mathematics*, *science*, *history*, *English* or *other*. By following this plan, a total of 535 middle-school and 505 secondary-school teachers were to be surveyed—100 teachers from each of the five topic areas above, representing all middle-school and secondary-school levels.

As with the school-level principal surveys, the teacher surveys came back to us at a very high response rate. We had an overall return rate of 86 percent, the highest return coming from middle-school teachers (92 percent) and the lowest coming from elementary-school teachers (75 percent).

Table 23. Stratified Sample Plan for Teacher Survey

	Subject	Number by Subject	Total
Elementary	—	—	282
Middle	Math	107	535
	Science	107	
	History	107	
	English	107	
	Other	107	
Secondary	Math	101	505
	Science	101	
	History	101	
	English	101	
	Other	101	
Total			1,322

Table 24. Teacher-Level Response Rates for Teacher Survey

	Subject	Percent Subject	Percent School Type	Response Count
Elementary	—	—	88%	255
Middle	Math	84%	86%	461
	Science	93%		
	History	81%		
	English	85%		
	Other	87%		
Secondary	Math	77%	80%	405
	Science	72%		
	History	81%		
	English	78%		
	Other	92%		
Total			85%	1,121

Data analysis of survey results

Weighting of School Data. While there was no difference in response rate based upon the methods used to recruit and follow-up on school surveys, there were small differences in response rates based on other school characteristics. Table 24 shows response rates across regions of the state and across type of school.

Urban schools tended to have a five percent to six percent lower response rate than suburban and rural schools; we judged this to be only a small difference. We also saw an eight to nine percent lower response rate from "other" schools, compared to elementary, middle, and secondary schools.

Table 25. School-Survey Response Rates by Location and Type

	Urban	Suburban	Rural	**Total**
Elementary	84%	89%	91%	88%
Middle	83%	86%	90%	87%
Secondary	80%	89%	89%	87%
Other	77%	78%	81%	79%
Total	83%	88%	89%	87%

We weighted the school-survey returns to adjust for the small response bias observed for school location and for type of school. This weighting would tend to remove any effect of the non-response bias, assuming that non-response did not relate to the content of the survey.

We computed the weight applied to each case by dividing the population count for a given subgroup by the actual number of surveys returned for that subgroup. For example, the subgroup of urban/other schools has a population count of 47 schools. A total of 36 of these schools returned surveys.

Dividing 47 by 36 results in a survey weight for these schools of 1.306. In the analysis, each of the urban/other surveys will count as being equal to about one-and-one-third surveys. On the other hand, rural/elementary surveys have a weight of about one-and-one-tenth surveys per response (349 / 316 = 1.104).

When looking for response bias, we must ask if responding and non-responding schools differ on critical attributes. For this survey, use of technology in the schools would be a critical attribute. If non-responding schools differed in technology use from responding schools, then the survey results might be biased by not including data from non-responding schools.

If the groups did not differ on these variables, it would suggest no bias in the survey results. An analysis of the survey returns for this study showed no significant difference between responding and non-responding schools on a number of critical variables, including:

- Average number of students per computer in the:

  Classroom; Market Data Retrieval; $\underline{F}$ (1, 674) = .021, $\underline{p}$ = .884

  Lab; Market Data Retrieval; $\underline{F}$ (1, 664) = .525, $\underline{p}$ = .469

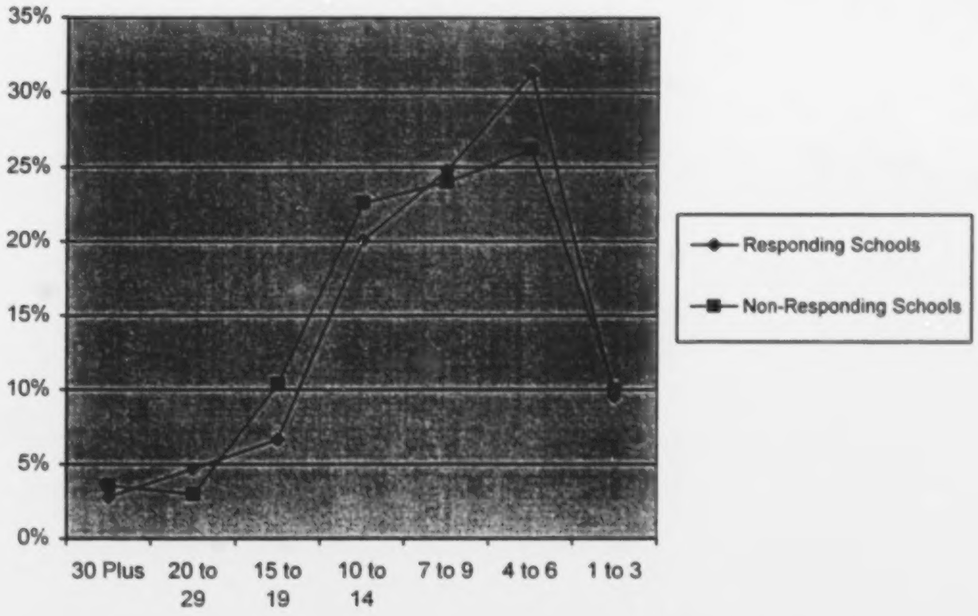
  Library; Market Data Retrieval; $\underline{F}$ (1, 803) = .009, $\underline{p}$ = .924

- Percent minority student enrollment, 1998; VDOE;
  $\underline{F}$ (1, 1784) = 3.179, $\underline{p}$ = .075

- Percent free school lunch, 1995; Common Core of Data;
  $\underline{F}$ (1, 1791) = .045, $\underline{p}$ = .831

Figure 25 below shows the distribution of students per computer for the entire school—including classrooms, labs, libraries and other instructional locations—for both responding schools and non-responding schools. This shows how similar responding and non-responding schools are on computer availability, again indicating no bias in the survey due to non-response.

Figure 25. Distribution of Number of Students per Computer for Responding and Non-Responding Schools



Weighting of Teacher Data. The teacher-sampling plan called for equal sample sizes for schools at the elementary, middle, and secondary levels, and for rural, suburban, and urban areas. This strategy gives greater precision in making comparisons between these groups. However, it also leads to over sampling of teachers in some strata and under sampling in other strata.

Over and under sampling can be adjusted for by sampling weights. Following a similar logic as used with school-level sampling weights just described, we weighed the teacher surveys to account for both disproportionate sampling in the original design and for non-response differences. These weights will allow us to estimate how all teachers in Virginia would answer the surveys had they been polled.

Disaggregating by Region, School Type, and Other Factors. We present the findings from the principal survey by: region of the state as defined by the eight regional study groups; level of school (elementary, middle, and secondary); location (rural, suburban, and urban); and, for middle and secondary levels, the content areas of mathematics, science, history, and English.

We present the findings from the teacher survey by level of school (elementary, middle, and secondary); by location (rural, suburban, and urban); and, for middle and secondary levels, by the content areas of mathematics, science, history, and English. Where appropriate to facilitate understanding, the presentation of results includes graphic representations.

Comparison of Principal and Teacher Surveys. The sampling of principal and teacher surveys from the same schools made it possible to directly compare answers given by both groups. This allowed for stronger cross-triangulation of findings from one group with the other. It also made it possible to examine with more validity the impact of various issues at both the teacher and principal levels.

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Case-Study Methodology

The Virginia Department of Education's RFP for this study specified the number of schools to be visited (48), the major research questions, and a number of other parameters needed to design the case-study component of the study. Based on several factors—the RFP, the Milken/NCREL/SRI consortium's decision to use the Milken Exchange's Seven Dimensions as a framework for the study, and such issues as practical constraints, including time limitations—we took four steps to gather and analyze the site-visit data.

The steps: (1) select the sites to be visited; (2) translate the research questions into more specific topics for data collection on-site; (3) train the site visitors and get the data collected; and (4) carry out a cross-case analysis of the site-visit reports. The following describes each of these steps.

1. Site Selection

We used a two-stage process to select the 48 schools to be visited. In the first stage, we selected 16 school divisions across the state. In the second stage, three schools were selected in each of the 16 divisions—one elementary school, one middle school, and one high school.

Selecting School Divisions. We used a number of factors to select the 16 school divisions: geography (exactly two divisions were selected in each of the eight "superintendent's regions" in the Commonwealth); urban status (i.e., whether the division is primarily urban, suburban, or rural); and convenience of access by site visitors working with a limited time and budget. A general goal of our selection process: to maximize the diversity of the sample while staying within certain constraints, such as including two school divisions in each region. Exhibit 1 below shows the set of 16 school divisions that we selected.

Selecting Schools. Based on national data about the uses of technology in schools (such as data from the National Assessment of Educational Progress, or NAEP), it seemed likely that a great many schools in Virginia (as in other parts of the United States) would not yet be making extensive use of technology (as gauged, for example, by the number of hours per week that students nationwide use computers and other technologies).

Therefore, we decided to include in the site-visit sample a greater number of schools that use technology heavily than would be expected by chance. This approach was feasible because the site-visit sample could not guarantee a statistical representation of all schools in the state, as the sample size was too small and too constrained (e.g., the RFP required us to select equal numbers of schools from each region). We designed the two statewide surveys (of principals and of teachers) to provide statistically representative "hard" data. We intended the site visits to provide much more detail about *how* technology is used in schools—as well as possible explanations of *why* certain patterns of use (or non-use) of technology are present.

Exhibit 1: Urban Status of School Divisions Selected for Site Visits, by Region [1]

School-Superintendents' Regions of the State

	1	2	3	4	5	6	7	8	Count
Rural		Northampton	Essex		Greene		Washington	Charlotte Halifax / S. Boston	6
Suburban	Hanover	Williamsburg-James City		Falls Church Loudon		Montgomery			5
Urban	Richmond City		Fredericksburg City		Harrisonburg City	Roanoke City	Radford City		5

Using data from a commercial vendor (*Market Data Retrieval*), which provided estimates of the technology available in each school, staff from the Milken/NCREL/SRI consortium selected a sample of schools that reportedly contained "high," "medium," or "low" amounts of technology (including computers, CD-ROM drives, modems, networks, and Internet access).

However, it is important to note that in some school divisions there was a limited choice of which schools would be visited because only one school existed at a particular level (e.g., high school)—and in certain low-population divisions, only one school existed at multiple levels. Geographic factors were also considered in selecting the schools, to make it possible for teams of two site visitors to travel between schools in a reasonable amount of time, preferably without renting more than one vehicle.

As noted, we selected schools that supposedly represented all levels of "technology intensity": high, medium, and low. Later, during the site visits, it became clear that the Market Data Retrieval information was, at best, a rough indication of the technology actually in use at the schools (and really, that was all that we could have hoped for).

Exhibit 2 displays the list of schools we selected for visits. Remarkably, none of the schools selected for a site visit refused to participate in the study. So all were, in fact, visited by members of the study team. Credit is due the principals and staff for their cooperation, often on short notice.

2. Translating the Research Questions Into Topics for Data Collection

The RFP included nine major research questions. Because these questions were so inclusive, they needed to be elaborated into more fine-grained topics for use by the site visitors. In turn, we organized these fine-grained topics according to the Seven Dimensions, which were used as a framework for the entire study. Then, to minimize the number of instruments, or forms, that site visitors needed to become familiar with, the topics became headings in a single, key document for use at each site: the site-visit report outline.

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[1] While not all the schools in a given school division have the same urban status, the selection was made based on the overall character of the division.

The Site-Visit Report Outline. The site-visit report outline is shown in Appendix E: Data Collection Instruments. At the top of that outline appears a table in which the researcher reported the region, division, and school being visited, and other key identifying information. Each site-visit report then began with a summary or overview of findings for the site, followed by nine main headings under which findings were to be reported. These are:

- Background Information about the site
- Learners
- Learning Environments
- Professional Competency
- System Capacity
- Community Connections
- Technology Capacity
- Accountability
- Key Issues raised at this site

Exhibit 2: List of Divisions and Schools Visited, by Region

Region	Division	School Name
1	Hanover	Elmont Elementary School
1	Hanover	Liberty Middle School
1	Hanover	Patrick Henry High School
1	Richmond City	Ginter Park Elementary School
1	Richmond City	Fred D. Thompson Middle School
1	Richmond City	John Marshall High School
2	Northampton	Kiptopeke Elementary School
2	Northampton	Northampton Middle School
2	Northampton	Northampton High School
2	Williamsburg-James City	D.J. Montague Elementary School
2	Williamsburg-James City	James Blair Middle School
2	Williamsburg-James City	Lafayette High School
3	Essex County	Tappahannock Elementary School
3	Essex County	Essex Intermediate School
3	Essex County	Essex High School
3	Fredericksburg City	Hugh Mercer Elementary School
3	Fredericksburg City	Walker-Grant Middle School
3	Fredericksburg City	James Monroe High School
4	Falls Church	Thomas Jefferson Elementary School
4	Falls Church	George Mason Middle School
4	Falls Church	George Mason High School
4	Loudon County	Meadowland Elementary School
4	Loudon County	Farmwell Station Middle School
4	Loudon County	Park View High School
5	Greene County	Nathanael Greene Elementary School
5	Greene County	William Monroe Middle School
5	Greene County	William Monroe High School
5	Harrisonburg City	Stone Spring Elementary School
5	Harrisonburg City	Thomas Harrison Middle School
5	Harrisonburg City	Harrisonburg High School
6	Montgomery County	Harding Avenue Elementary School
6	Montgomery County	Blacksburg Middle School
6	Montgomery County	Blacksburg High School
6	Roanoke City	Monterey Elementary School
6	Roanoke City	James Madison Middle School
6	Roanoke City	Patrick Henry High School
7	Washington County	Rhea Valley Elementary School
7	Washington County	Glade Spring Middle School
7	Washington County	Patrick Henry High School
7	Radford City	Belle Heth Elementary School
7	Radford City	John N. Dalton Intermediate School
7	Radford City	Radford High School
8	Charlotte County	J. Murray Jeffress Elementary School
8	Charlotte County	Central Middle School
8	Charlotte County	Randolph Henry Senior High School
8	Halifax / South Boston	Turbeville Elementary School
8	Halifax / South Boston	Halifax County Middle School
8	Halifax / South Boston	Halifax County High School

3. Training Site Visitors and Collecting Data

To visit 48 schools in a short period of time, a total of 14 site visitors, representing Milken, NCREL, and SRI, worked on this study. We assigned pairs of researchers to each of the eight regions, and the more-senior member of each pair was designated as the lead researcher.

Two researchers conducted site visits in two different regions (not at the same time, of course), while the six other teams of researchers worked in only one region each. Each pair of researchers was thus responsible for visiting six schools spread over two school divisions: one elementary school, one middle school and one high school in each division.

The Virginia DOE provided the consortium with copies of the technology plans for each of the 16 school divisions. The consortium then gave the researchers a copy of the plans for the school divisions where they would conduct site visits. Since we visited only two school divisions in each region, each pair of researchers needed only assemble background information about two school districts. Putting it another way, background information about any single school division was useful for three different schools visited in that division.

Researchers also received a variety of additional background information, including: contact information for each school; maps; excerpts from the RFP; additional research studies about the uses of technology in schools; the site-visit report outline; sample schedules for conducting site visits; and copies of the survey forms being sent to principals and a statewide sample of teachers.

We also provided researchers a list of useful Web sites (such as for the Virginia Department of Education). Most of these materials were bound into a training handbook sent to each researcher in advance of a site-visitor training event.

Site-visitor training took place on September 28, 1998, at SRI International's offices in Arlington, Virginia. Dr. Andrew Zucker, the leader of the site visit component of the study, directed the one-day training event. All prospective site visitors attended and, later that day, many of them traveled to the region where they would conduct site visits.

A variety of activities took place during the training event, including observing videotapes of teachers using technology in elementary-, middle-, and high school classrooms. These simulated classroom observations were then thoroughly discussed in light of the goals and requirements of the Virginia study; prior research on the uses of technology in schools; the site-visit report outline; and other perspectives.

The great majority of school visits took place during the weeks of September 28 and October 5. Some took place later in October. One visit to a middle school was conducted during the week prior to the training event. A full report of that site visit, based on the site-visit report outline, was available at the training on September 28 to serve as example and discussion piece for the researchers.

Leaders of the two-person teams in each region were the ones responsible for contacting school principals and arranging details of the visits. In mid-September, Dr. Zucker and staff at SRI faxed letters to all the principals, alerting them to the selection of their school, identifying the name of the lead researcher in that region, and suggesting which week would be best for the visit to take place. (A sample letter is included in Appendix E.)

The lead researchers for each region had copies of these letters and, in most cases, were able to arrange visits to the corresponding schools within the time-period suggested in the letter. The dates were chosen based on the availability of the researchers and the requirements in the RFP.

4. Cross-Case Analysis of the Site Visit Reports

All site-visit reports (which averaged about seven pages in length, single-spaced) were delivered to SRI in electronic form. While we also used paper copies for the cross-case analysis, the availability of the computer files facilitated sorting and searching the documents for key words, issues, and examples.

The cross-case analysis involved several passes through the voluminous database of information about 48 schools. The first pass focused on "the big picture," including the summary of findings for each site, the key issues raised at that site. Based on this information, as well as detailed reading of a number of site-visit reports that illuminated key issues, a one-page summary of preliminary findings was developed to be shared with other members of the Milken/ NCREL/SRI consortium. A particular purpose of this document was to inform the focus groups, as required by the RFP.

Other passes through the data focused on a number of specific topics and perspectives. For example, we identified major findings for each of *the Seven Dimensions of Progress on Education Technology* used as a framework for the entire study. A team of three researchers was responsible for the cross-case analysis.

The "triangulation" of data from the site visits, surveys, and focus groups was enhanced by bringing together, on several occasions, the core research team for the consortium. At one-day meetings, the research team compared findings across the main data sources. Not surprisingly, given the excellent overall design specified in the RFP, the key findings from all data sources were generally in accord. These meetings helped a great deal in reaching convergence on the major findings and recommendations.

Focus-Group Methodology

As stipulated in the RFP, the purpose of the focus-groups was to strengthen and enrich survey and site-visit data, as well as help in formulating recommendations for future educational technology improvements to implement the Board's Six-Year Education Technology Plan. To accomplish this, we planned for and held 10 focus groups with educators and policymakers across the state.

We took four key steps to gather and analyze the focus group data: (1) selection of participants; (2) development of discussion protocols based on the study's guiding questions and the Seven Dimensions; (3) facilitation of focus-group discussions; and (4) cross-case analysis of the focus-group reports. The following describes each of these steps.

1. Selection of Participants

We decided that 10 focus group sessions would be conducted: nine with teachers and administrators, and one with members from the Virginia Education Technology Advisory Committee—which represents business/industry, higher education, K-12 education, parents, and community.

To cover as much of the state as possible, the selectors of educator focus-group sites focused on all eight regions and purposefully targeted school divisions *not* represented in the site-visit study. We used three stratifiers to select which school divisions were represented in the focus groups: (1) region of the state; (2) school level; and (3) urbanicity.

In addition, we had two important logistical considerations: (1) since only three teams were conducting the focus groups (versus eight teams on the site visits), these three teams had to cover more of the state within the same time period; (2) travel time for participants needed to be minimal (no more than 30 miles' drive); and (3) the focus groups needed to be clustered by level (elementary, middle, high school), since the issues surrounding technology access, use and integration were likely to differ across these levels. Based on these requirements, Exhibit 3 below represents the strategy for selecting the school divisions to invite.

Based on this strategy, we faxed a letter of invitation to school-division superintendents, explaining the purpose of the focus groups for the study and asking them to select a specified number of teachers and administrators from their schools who could represent a balanced perspective on education technology.

We then used a follow-up call to secure participation and to collect the names and addresses of potential participants. Next, we mailed each potential participant their own formal invitation to attend, including an overview of the study and background materials—including the Six Goals for Technology and a Seven-Dimensions matrix.

We also told participants they would receive a check for $50 as compensation participating and to cover any costs incurred in attending the discussions. (See Appendix E: Data Collection Instruments, for examples of letters.) A total of 114 teachers and administrators, representing 20 school divisions, participated in the focus groups. Ten members of VETAC participated in a separate policymaker focus group held in Richmond, VA.

Exhibit 3. Focus Group Participant Selection Strategy

	Region 1**	Region 2	Region 3	Region 4	Region 5	Region 6	Region 7	Region 8
Rural	Sussex Cty; Surry Cty; Isle of Wight (elementary)			Warren; Fauquier	Fluvanna Cty	Pittsylvania Cty Danville City	Galax City; Carroll Cty	Brunswick Cty[1]; Greenville Cty
Suburban			Spotsylvania Cty; Stafford Cty; King George		Albemarle Cty			
Urban	Richmond City (hs/middle school)	Norfolk; Portsmouth; VA Beach; Hampton			Charlottesville City			
Level	*Ele; HS/Mid*	*Middle/HS*	*Middle/HS*	*Middle/HS*	*Elementary*	*Elementary*	*Elementary*	*Middle/HS*

** Region 1 has two focus groups (one elementary/one high school) the other seven regions have one focus group each.

2. Development of Focus-Group Discussion Protocols

As with the survey and site-visit instruments, we framed the focus-group guiding protocol and the subsequent focus-group report outline around the Seven Dimensions of Progress. (Copies of both instruments are found in Appendix E.)

The protocol included an overview of the study, the purpose of the focus groups, an "ice-breaker" question to get participants quickly engaged, and several questions around the Seven Dimensions and the participants' experiences with education technology. We also asked to provide specific recommendations to the state as it moves forward with the Six-Year Plan.

After each focus group, we asked the research team to write a brief report of the results, using the following format:

- Snapshot of participants
- Summary of the discussion overall
- Summary of each of the Seven Dimensions covered
- Advice to the state

In addition, we asked the researchers, if appropriate and time permitting, to share with the participants information collected from the survey and site visits, and to get a "reality check" about their perceptions of the outcomes to date. Any information covered here was also to be included in the focus-group reports.

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[1] Brunswick County was invited but did not participate.

3. Facilitation of Focus-Group Discussions

In conducting the 10 focus groups, NCREL and Milken sent three teams of two researchers each to visit Virginia during the weeks of October 19 and October 26. Each focus-group team included a trained and experienced facilitator who led the discussion using the standardized protocols, and an observer/recorder, who noted observations and took minutes on a laptop computer.

Each of the educator focus groups was held in one of the participating schools—usually in a media center or classroom. The policymaker focus group was held at the Virginia Department of Education offices. Each focus group lasted from 90 to 120 minutes.

With the permission of the participants, we audio-taped the focus-group sessions. While generally following the structured protocol in leading the participants, the lead researchers did make slight adjustments to the sequence and type of questions asked, in order to draw out the most thorough, detailed and textured information from participants.

4. Cross-Case Analysis of the Focus-Group Reports

Within a week of completing the focus groups, each team submitted a completed focus-group report to Dr. Shannon Cahill for analysis. An initial pass at each report revealed common themes across the groups participating in the discussion, and the Seven Dimensions served as the organizational structure of the analysis.

In examining the data, we placed more emphasis on identifying key issues among the participants than on quantifying the frequency of responses. Several more passes at the data were used to cluster themes and to pull out illustrative quotes. Because one objective of conducting the focus groups was to solicit the participants' suggestions and recommendations concerning the future direction for education technology in the state, the analysis also included a clustering of these recommendations across each dimension.

A Cautionary Note: The purpose of a focus group is to collect specific information based on a predetermined issue(s) without necessarily reaching consensus. Because focus groups include relatively small samples of a given population, consider these findings exploratory and illustrative, rather than representative of the entire populations studied. However, despite the limitations imposed by the small sample size, this focus-group effort did effectively identify major issues in the educators' knowledge of and perceptions about technology in education, as well as useful insights for future policy-planning and research directions.

Technical Report: Survey of 1634 School Principals And 1121 Educators

Bill Quinn, Ed.D.
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LEARNERS

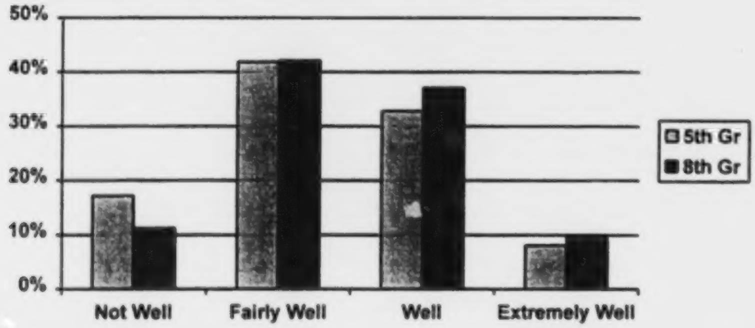
Are learners using technology in ways that deepen their understanding of academic content and, at the same time, advancing their knowledge of the world around them? This section presents survey ratings of how well students are prepared to meet or exceed the Virginia SOL for Computers and Technology. This section also presents information on how technology use in Commonwealth schools has influenced students in the areas of:

- fluency in using technology;
- strengthening the basics;
- developing higher level skills;
- increasing relevancy;
- motivation to learn.

How well prepared are students to meet or exceed the Virginia Computers and Technology SOL?

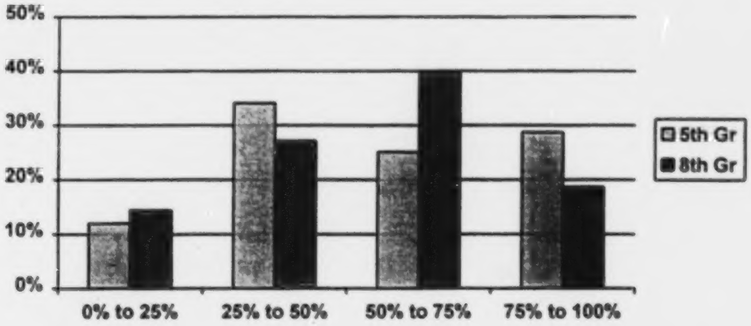
When elementary and middle school principals rated how well their 5th- or 8th-grade students met or exceeded the Virginia SOL for Computers and Technology, very few (eight percent elementary, 10 percent middle) said their students were "extremely well" prepared. About one-third of the principals said their students were "well" prepared (33 percent elementary, 37 percent middle). More than four-tenths (42 percent elementary, 42 percent middle) said they were "fairly well" prepared; i.e., they had done some computer work but did *not* have the skills to meet the SOL goals. More than one-tenth (17 percent elementary, 11 percent middle) said their students were "not well" prepared. Overall, then, between forty and fifty percent of the principals with 5th- and 8th- grade students thought the students in their schools were prepared for the technology SOL standards. Principals in more than half these schools did not feel that their 5th- or 8th-graders were prepared.

Figure 1. Principals' Ratings of Student Proficiency in Meeting or Exceeding Virginia Computer/Technology Standards of Learning



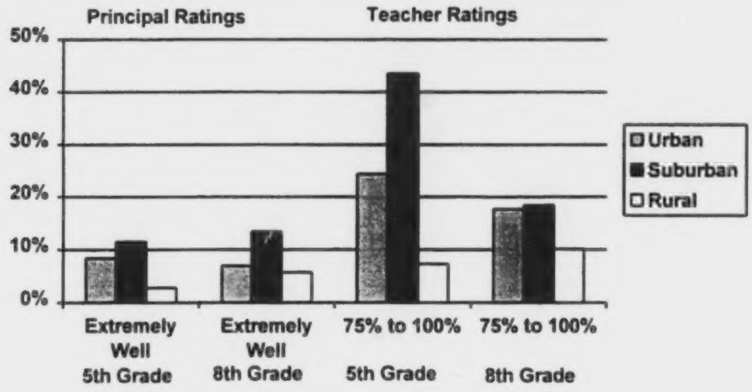
When teachers of 5th- and 8th-grade students were asked a similar question about what proportion of their students would meet or exceed the Virginia SOL for Computers/Technology, they gave a pattern of answers similar to that of the principals: a sizable portion of students is rated as meeting or exceeding the computer/technology SOL, but another sizable portion is not.

Figure 2. Teachers' Ratings of Student Proficiency in Meeting or Exceeding Virginia Computer/Technology Standards of Learning



A comparison of principal and teacher ratings from different locations in the Commonwealth shows that suburban schools are more likely than rural or urban schools to rate their students as prepared for the Computers and Technology SOL. This difference appears obvious in the findings for the highest-rating category in the surveys: "extremely well" for principal surveys and "75 percent to 100 percent" proficient for teacher surveys. Students in suburban schools are typically rated as being twice as proficient or more than rural students; suburban students are typically given higher ratings than urban students, but not by so large a margin.

Figure 3. Percent of Urban, Suburban, and Rural Principals and Teachers Giving the Highest Ratings for Student Computer/Technology SOL Proficiency



This difference is most probably reflective of the greater social and economic advantages present in many suburban communities. Supporting this interpretation is a negative correlation between the percentage of students in schools qualifying for free school lunch and the SOL proficiency ratings given by the principals and teachers. The negative correlation was somewhat stronger in the 5th grade than in the 8th grade. This may be because computer proficiency in the 5th grade is more a result of home experiences with a computer while 8th-grade proficiency is more dependent upon school computer experiences (which do not differ by student economic status).

Table 1. Correlation of Principals' and Teachers' Ratings of Student Proficiency to Percent of Students in School Qualifying for Free Lunch

	Correlation with % Free Lunch
Principal Ratings of:	
5th-Grade Proficiency	-.33
8th-Grade Proficiency	-.25
5th-and 8th-Grade Teacher Ratings of:	
5th-Grade Proficiency	-.46
8th-Grade Proficiency	-.18

Taken together, these findings indicate progress in helping students meet or exceed Virginia's Computers and Technology SOL, but significant progress is still needed for the majority of Commonwealth schools—especially in urban and rural schools and schools serving more economically disadvantaged students.

How has technology influenced students?

Fluency. Almost all principals (95 percent) and teachers (94 percent) said that using technology in the schools had improved the overall fluency of students. Almost half—46 percent of principals and 45 percent of teachers—said students were "much improved" in their ability to use technology for a variety of educational purposes. Many students "grab hold" and learn to use computers for a variety of tasks. This is the area of greatest impact of technology use in schools.

Strengthening the basics. Do students learn the basics in English, mathematics, science, and history with more depth and understanding because of the use of technology? Principal and teacher ratings suggested that technology use may have a moderate positive influence on student achievement in these areas, especially overall academic achievement, but that in only eight to 19 percent of the areas surveyed was technology rated as resulting in "much-improved" student performance.

Table 2. Principals' and Teachers' Ratings of Technology's Impact on Student Learning in Curriculum Areas

Area of Impact	**Principal Ratings**		**Teacher Ratings**	
	Much Improved	**Somewhat Improved**	**Much Improved**	**Somewhat Improved**
Knowledge in English	17%	66%	19%	53%
Overall level of academic achievement	14%	75%	18%	66%
Understanding the "basics" in the subjects you teach [a]	–	–	18%	52%
Knowledge in science	13%	63%	16%	54%
The *breadth* of students' under-standing of the subject(s) you teach [a]	–	–	15% [b]	55% [b]
Knowledge in history/social science	8%	63%	14%	52%
The *depth* of students' understanding of the subject(s) you teach [a]	–	–	13% [b]	55% [b]
Knowledge in mathematics	13%	69%	12%	60%

[a] Question asked only on teacher survey [b] Much Increased and Somewhat Increased

Elementary school principals and teachers were less likely to say that technology leads to much or somewhat improved knowledge in science and, to a lesser degree, English and history/social science. One possible reason may be that at the elementary level, fewer curriculum and content resources actually integrate technology.

Developing higher-level skills. About one in five teachers (18 percent to 20 percent) rated technology as much improving students' higher-level thinking skills in a number of areas. About half of the teachers felt technology use had somewhat improved students' higher-level thinking skills. Principals were as positive or a little less positive in their ratings of technology impact on students' problem-solving and communication skills.

Table 3. Principals' and Teachers' Ratings of Technology's Impact on Student Higher-Level Learning Skills

Area of Impact	Principal Ratings		Teacher Ratings	
	Much Improved	Somewhat Improved	Much Improved	Somewhat Improved
Higher-level skills (e.g. problem-solving, constructing knowledge)	17%	65%	20%	56%
Communicating and sharing ideas with others outside the school	20%	56%[b]	20%[b]	53%[b]
Ability to set their own pace for learning	14%	52%	19%	42%
Students' independence as learners[a]	–	–	18%	61%
Student engagement in inquiry-based learning projects[a]	–	–	18%[b]	61%[b]

[a] Question asked only on teacher survey [b] Much Increased and Somewhat Increased

Increasing relevancy. Virginia principals and teachers indicated that technology use increases the relevance of learning experiences in a number of ways. More than three-fourths of them (82 percent of the surveyed principals, 79 percent of the surveyed teachers) said it increases the amount of choice students have in selecting projects and assignments. Similar proportions said technology use allows and encourages students to increase the number of roles they assume in learning (e.g., trainer, publisher).

It should be noted that in elementary schools, students were less likely to have more choice in activities due to technology use. About one-in-five elementary principals (20 percent) and teachers (22 percent) marked "much increased" for this question. About one-in-three middle and secondary principals (32 percent) and teachers (33 percent) marked "much increased." There were no school-level differences on the other items for this issue.

Table 4. Principals' and Teachers' Ratings of Technology's Impact on Increasing Relevance of Student Learning Experiences

Area of Impact	Principal Ratings		Teacher Ratings	
	Much Improved	Somewhat Improved	Much Improved	Somewhat Improved
Amount of choice students have in selecting projects/assignments for study	24%	58%	28%	51%
Student engagement in project-based activities [a]	–	–	27%	56%
Students' attentiveness/ engagement in class [a]	–	–	22%	46%
Number of roles students assume in learning (e.g., trainer, publisher [a]	20%	63%	21%	59%
Amount of time students spend working with other students in their class/school [a]	–	–	16%	53%

[a] Question asked only on teacher survey

Motivation to learn. Technology use has a substantial, positive impact on student motivation to learn and interest in school. Students are increasing the use of technology for their homework. Technology use motivates students to go beyond the minimal assignment. It may even have some small impact on student attendance, particularly on days when computer use is scheduled, and on alleviating other behavioral concerns. Teachers and principals gave very similar patterns of answers on motivation-to-learn questions asked of both groups.

Elementary teachers were more likely to say that the use of technology had much improved their students' motivation to learn and go beyond minimal assignments. Almost one-of-two elementary teachers (46 percent) said this, compared to about one-in-three middle-school teachers (34 percent) and secondary-school teachers (34 percent).

As noted above, principals and teachers said using technology had only little impact on dropout rates, number of behavior referrals, or school attendance. However, there was one exception. One-in-five (20 percent) of urban school teachers reported that the use of technology had much increased student attendance on days when technology was scheduled to be used. Less than one-in-10 suburban (eight percent) or rural teachers (nine percent) reported a similar effect for their students. Given the needs of urban schools, this is an important area of benefit.

Table 5. Principals' and Teachers' Ratings of Technology's Impact on Student Motivation to Learn

Area of Impact	Principal Ratings		Teacher Ratings	
	Much Improved	Somewhat Improved	Much Improved	Somewhat Improved
Number of assignments students turn in that were produced with technology (e.g., word processing, e-mail, spreadsheets)	–	–	45%	39%
Motivation to learn, going beyond minimal assignments	38% [b]	56% [b]	39% [b]	45% [b]
Interest in school	15%	68%	16%	64%
School attendance on days when technology is scheduled to be used [a]	–	–	10%	20%
School attendance (in general)	3%	21%	4%	17%
The amount of schoolwork students do at home [a]	–	–	4%	34%
Number of behavioral referrals	2%	7%	4%	6%
Dropout rate [c]	1%	6%	–	–

[a] Question asked only on teacher survey

[b] Much Increased and Somewhat Increased

[c] Question asked only on principal survey

Dimension 2: Learning Environments

This section examines the degree to which the learning environments in Virginia schools are designed to achieve high student performance through the alignment of standards, research-proven learning practices and contemporary technology. As the *Six-Year Educational Technology Plan for Virginia (1996-2002)* recognizes, simply adding technology to the classroom is not enough. To be effective, technology needs to be part of an overall effort to create learning environments that combine the best of traditional teaching with cognitive-learning theory. Key elements in building such learning environments are covered below.

Technology access. Access to technology is the first issue to address when evaluating a school's technology-learning environment. Teachers and students need access to productivity tools, online services, and media-based instructional materials. This section addresses the *actual* time students and teachers use technology for instruction and learning. Statewide, teachers estimated that each student in their classrooms spent an average of about one-half of a class period per week, 34 minutes, using a computer for any reason. On this same question, principals gave a higher estimate, indicating that each student spent an average of about one class period per week, 48 minutes, using a computer for any educational purpose. Teachers indicated that student computer use centered mostly around word processing and content-based drill-and-practice programs.

Students were less involved with other technologies such as viewing videotapes or television, using technology peripherals, using a variety of other software programs, using graphing calculators, or using the Internet. Only infrequently, if at all, did students participate in interactive video for distance learning; work with lasers, robotics or related devices; or create Web pages for the Internet.

As would be expected, patterns of technology access were often quite different among Virginia's elementary-, middle-, and secondary-schools. Principals and teachers reported that elementary school students each spent more time per week using computers (51 minutes, said the principals, 41 minutes, said the teachers) than did middle or secondary school students (43 and 44 minutes, said the principals, 24 and 29 minutes, said the teachers). Using either principal or teacher estimates, this works out to about an extra period per month in elementary schools using computers. Elementary students spent more time than other students on word processing and content-based drill-and-practice, and much less time on most other applications of computers and other technology.

Table 6. Principals' and Teachers' Estimates of Time Per Week a Typical Student in Their School/Classroom Uses Technology

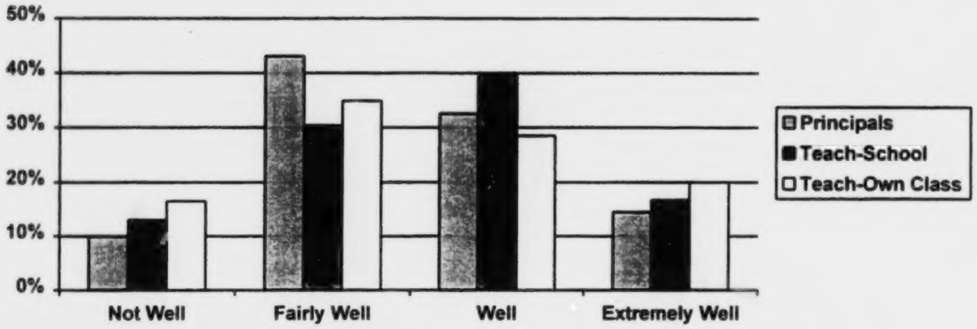
Area of Student Activity	Principal Estimates in Minutes per Week				Teacher Estimates in Minutes per Week			
	0-15	15-30	30-60	60+	0-15	15-30	30-60	60+
Using computers for any educational purpose	6%	20%	41%	33%	30%	24%	25%	21%
Word processing[a]	–	–	–	–	49%	24%	17%	11%
Using content-specific programs for purpose of drill and practice[a]	–	–	–	–	50%	25%	15%	10%
Viewing videotapes or television in a non-interactive environment	32%	38%	25%	6%	61%	25%	11%	3%
Using technology peripherals for educational purposes (e.g., scanners, printers)	45%	28%	20%	8%	65%	19%	8%	7%
Using desktop publishing and/or graphics programs[a]	–	–	–	–	69%	14%	11%	6%
Using graphing and/or scientific calculators	57%	17%	15%	12%	74%	12%	6%	5%
Researching information on CD-ROM[a]	–	–	–	–	73%	17%	7%	3%
Researching information on the Internet[a]	–	–	–	–	74%	17%	8%	3%
Using computer simulations[a]	–	–	–	–	82%	9%	6%	3%
Managing databases[a]	–	–	–	–	87%	6%	4%	3%
Managing/analyzing spreadsheets[a]	–	–	–	–	89%	5%	3%	3%
Participating in an interactive video environment (e.g., for distance learning)	88%	7%	3%	2%	91%	6%	2%	1%
Working with lasers, robotics, remote sensors, etc.	90%	6%	3%	1%	94%	3%	2%	1%
Developing Web pages[a]	–	–	–	–	96%	2%	1%	1%

[a] Question asked only on teacher survey

Learning content. Technology should be integrated into the classroom curriculum, reinforcing academic standards and content, rather than as typing has been and is being taught—as a separate subject unto itself. How well technology is integrated into learning within the schools is a key attribute of learning environments. When Commonwealth principals rated how well each of their schools had integrated technology, 47 percent marked "extremely well" or "well." The remaining principals said their school integrated technology into learning only "fairly well" or "not well."

Teachers were a bit more positive about how well each of their schools was integrating technology into learning, with 57 percent marking "extremely well" or " well." When asked how well they integrate technology into learning in their own classrooms, teachers gave a wider range of answers than when rating the whole school; higher percentages rated either not well (17 percent) or extremely well (20 percent) when assessing their own integration of technology into learning. There were no differences between elementary, middle, and secondary schools or between urban, suburban, or rural schools on this question.

Figure 4. Principals' and Teachers' Ratings of How Well Technology is Integrated Into Learning in Their School (Both) and Own Classroom (Teachers Only)

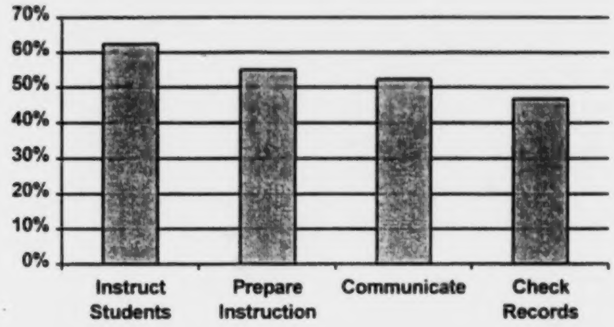


Learning context and communication. Research studies show that effective technology use occurs in a learning context where people use technology as a tool for researching issues, solving problems, and communicating results. One way to establish this learning and communication context for technology use: for teachers and other school staff to use technology as an integral part of their work. This translates into time using computers to accomplish a range of work-related purposes.

When asked how much time per week teachers and other school staff spend using computers and similar technologies for their work, two-thirds of Virginia's principals answered that their teachers spend over an hour per week using computers. Only eight percent of the principals said their teachers spend less than 30 minutes per week using computers. As other questions in the survey indicate, more suburban teachers use computers than do their urban or rural counterparts. About seven-in-10 principals in suburban schools indicated that the typical teacher spends more than 60 minutes per week using a computer, compared with about six-in-10 principals in urban and rural schools saying this. Similarly, middle and secondary principals reported more computer use by teachers than did elementary principals. Seven-in-10 middle and secondary school principals rated teachers as spending more than 60 minutes per week on computers, compared to about six-in-10 elementary principals saying this.

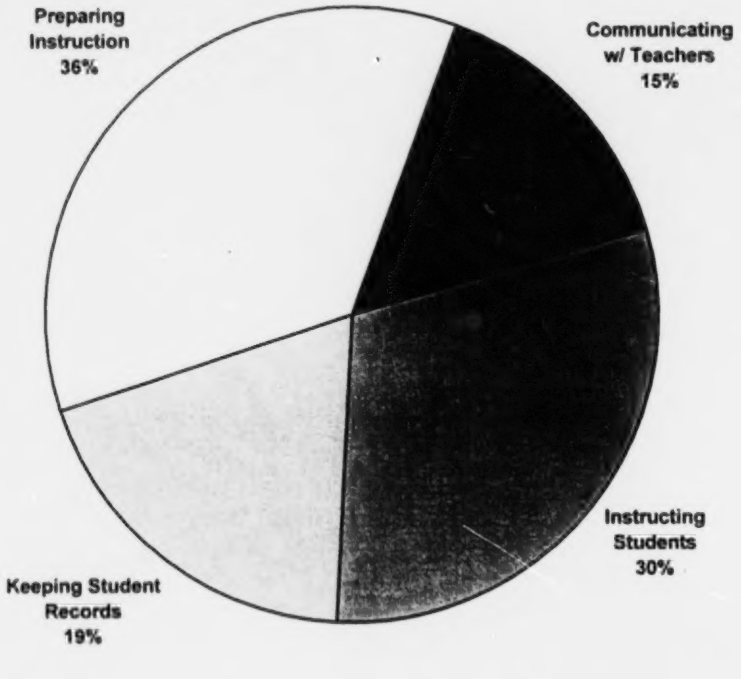
When principals were asked what their teachers used educational technology for, the most-common answer was instructing students, closely followed by preparing for instruction, communicating with parents or colleagues, and checking or recording student information. Elementary principals were somewhat more likely to report their teachers using computers for instruction, and less for student record-keeping. Rural principals tended to report modestly lower rates of teachers using computers than were reported by suburban and urban principals.

Figure 5. Principal Estimates of Percentages of Teachers Using Technology for Instructional Activities



Teachers were asked a similar question—to report what percentage of their technology use in their work fell into various categories. Their answers reflected the same general pattern as principals. Preparing for instruction and instructing students occupied a larger percentage of their time; working with student records and communicating with parents or colleagues inside or outside of the school involved a somewhat smaller percentage of their time.

Figure 6. Teachers' Report of How Their Own Computer Time Is Divided Among Instructional Activities



Most teachers spend an hour or more per week using computers for word processing and basic computer applications, including accessing the Internet. Most teachers spend some time each week on a wide range of additional technology activities, as listed in Table 7. Very few teachers use computers to author Web pages for the Internet, use e-mail, or work with lasers, robotics, etc. Across all these activities, elementary teachers reported they used computers for less time than did middle or secondary teachers.

Table 7. Teachers' Estimates of Time Per Week They Spend Using Technology on the Following Activities

Area of Teacher Activity	Time Estimates in Minutes per Week			
	0 -15 min.	15-30 min.	30-60 min.	60+ min.
Word processing	7%	13%	21%	60%
Basic computer operations (including Internet applications)	10%	10%	21%	60%
Conducting research that contributes to lesson plans and curriculum design	34%	23%	23%	20%
Researching information on the Internet	37%	19%	20%	24%
Checking or reporting on student information	42%	22%	17%	20%
Communicating with colleagues inside and outside the school /division	43%	21%	18%	18%
Using desktop publishing and/or graphics programs	45%	18%	16%	22%
Developing instructional presentations	46%	19%	20%	15%
Researching information on CD-ROM	57%	22%	14%	7%
Managing/analyzing spreadsheets	59%	16%	14%	11%
Developing Web pages	92%	4%	2%	3%
Working with lasers, robotics, remote sensors, etc.	92%	3%	2%	3%
Using e-mail to communicate with parents	92%	5%	2%	2%
Using the Internet to provide the community with information about your classroom or school	94%	4%	1%	1%

School culture. The school culture should encourage, enable and reward educators in order to improve the learning and teaching process through the effective use of technology. Principals and teachers judged that technology impacted their schools' culture in several areas. Principals and teachers identified the same set of top three outcomes:

- improved ability/willingness to share ideas and skills with others (86 percent of the principals, 77 percent of the teachers);
- improved general staff morale (78 percent of the principals, 68 percent of the teachers); and
- improved efficiency or effectiveness of school management (90 percent of the principals, 66 percent of the teachers), and staff ability/willingness to share ideas and skills with others (84 percent).

Principals and teachers in urban and suburban communities tended to report about five to 10 percent more positive impacts on most questions regarding school culture than did principals in rural schools. Principals and teachers from elementary schools reported more positive impacts on relationships with parents and the community than were reported by middle school and secondary school principals and teachers.

Table 8. Principals' and Teachers' Ratings of Technology's Impact on School Culture

Area of Student Impact	Principal Ratings		Teacher Ratings	
	Much Improved	Somewhat Improved	Much Improved	Somewhat Improved
Ability/willingness to share ideas and skills with others	34%	52%	34%	43%
General morale	26%	52%	33%	35%
Efficiency or effectiveness of classroom management	43%	47%	29%	37%
Sense of empowerment to address school issues	14%	42%	14%	28%
Ability to work in teams to identify goals, make decisions, solve problems	17%	46%	14%	35%
Relationship with parents and the community	19%	58%	12%	31%

Teachers were asked additional questions about the impact of technology use on their performance as teachers. Nine out of 10 (91 percent) reported that technology use had increased the amount of materials and resources they used in their classes. Many teachers also reported making improvements in the overall quality of their instruction, increasing the breadth of instructional strategies they used, and other curriculum changes.

Comparing elementary-, middle-, and secondary-school teachers, about 10 percent more middle- and secondary-school teachers said they had "much increased" their performance in each of these areas. It seems that using computers results in more changes to middle- and secondary-school instruction than it does to elementary-level instruction. Or it may be elementary teachers have been using technology for more time, so they have already incorporated it into their curriculum. Or it may be that the use of technology at elementary levels involves simpler and fewer applications, so it is easier to integrate it into the curriculum.

Table 9. Teachers' Ratings of Technology's Impact on Their Behavior

Area of Instructional Impact	Teacher Ratings	
	Much Increased	Somewhat Increased
The amount of materials and resources you use in your class(es)	40%	51%
Overall quality of instruction you deliver	33%[a]	54%[a]
Your repertoire of instructional strategies	28%	58%
The number of changes you've made in the curriculum	25%	57%
Your participation in instructional planning at the department or school level	17%	42%

[a] Much Improved and Somewhat Improved

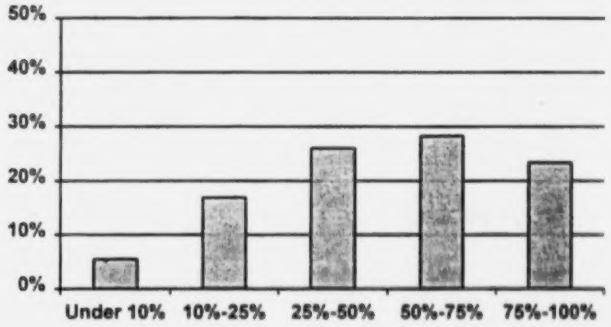
Dimension 3: Professional Competency

Training of professional staff is a necessary component of successfully using technology in education. For this section we asked principals and teachers to rate the adequacy of teacher training for using technology in education, as well as teacher proficiency on the Technology Standards for Instructional Personnel that have been adopted by the state. We then delved into ways in which schools or divisions have emphasized teacher training for integrating technology into instructional practices, with the understanding that such an emphasis is the first step toward actual integration of technology into instructional practices.

Core technology fluency. Teacher preparedness begins with teacher core training. When reflecting on how well teacher-preparation institutions are training teachers to use technology in education, over one-third of principals (35 percent) and teachers (44 percent) felt the institutions were training teachers "extremely well" or "well". About one-third felt the institutions were preparing them "fairly well" (40 percent of the principals, 34 percent of the teachers). About one-fourth felt the institutions were doing "not well" at all (25 percent of the principals, 23 percent of the teachers). These ratings were quite consistent across location of school and level of school.

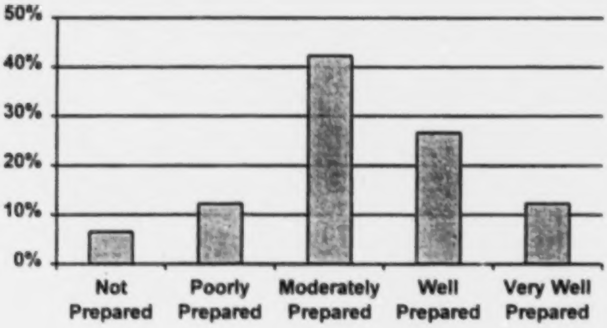
Principals were then asked to go beyond rating the institutions that train their teachers, and to indicate what percentage of their teachers met the Technology Standards for Instructional Personnel. About one-half of the principals felt the majority of their faculty met the standards. Figure 7 below displays proportions across all categories. Examining these findings across school level and location, no significant differences were found.

Figure 7. Principals' Estimates of Percentages of Teachers Who Meet or Exceed the Virginia Technology Standards for Instructional Personnel



On a similar item, teachers were asked how well prepared they were to use technology in instruction. Just under four-in-10 said they were "very well prepared" or "well prepared"; another-four- in-10 said they were "moderately prepared". About two-in-10 said they were "poorly prepared" or "not prepared" to use technology in instruction. Examining these findings across school level and location, no significant differences were found.

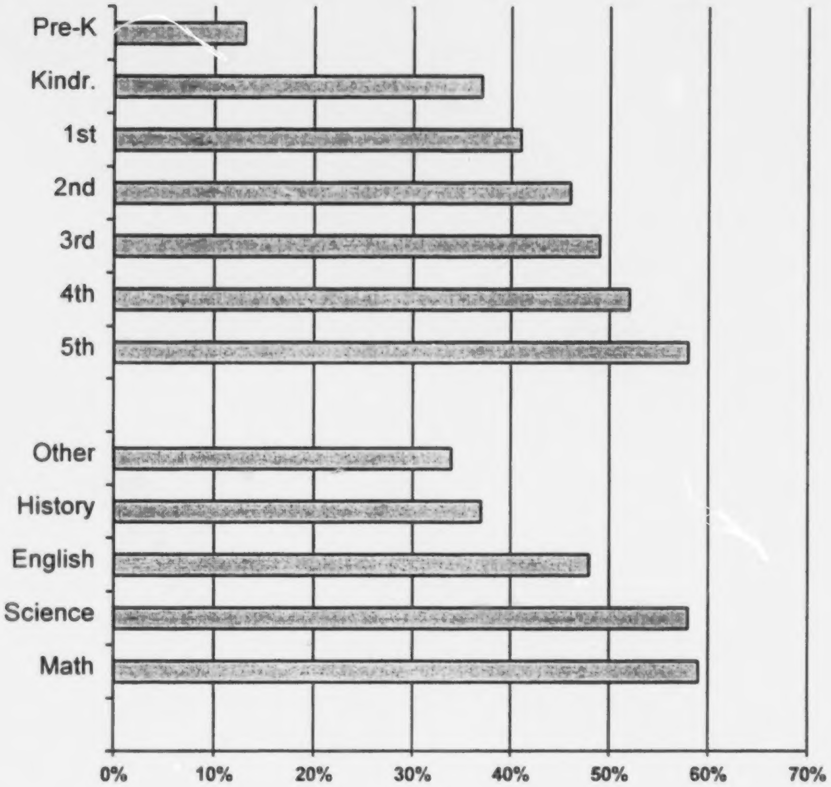
Figure 8. Teachers' Self-Evaluation of How Well-Prepared They Are for Using Technology in Instruction



Finally, principals were asked at which grade levels and in which subjects the majority of teachers were proficient in the Technology Standards for Instructional Personnel. Figure 9 illustrates the discussion to follow. Better than half of the elementary-school principals indicated that the majority of their 1st through 5th grade teachers were proficient. While principals clearly reported a lower level of teacher proficiency in the pre-kindergarten and kindergarten grades, this may reflect a perceived lesser need for teacher proficiency. There is a belief that the use of technology has more limited application in the lower grades.

In middle and secondary schools, teachers were grouped across subjects. More than two-thirds of the principals indicated that the majority of their math and science teachers were proficient, while their estimate dropped to around half for English and history teachers.

Figure 9. Percent of Principals Stating a Majority of Teachers are Proficient



Thus far, the findings suggest that some teacher-training institutions are doing an adequate job of training teachers to use technology, while others are seriously deficient at this. This is most evident in that 25 percent to 50 percent of principals do not feel their faculties are proficient in the skills outlined by the technology standards. Now the discussion of survey findings moves into division- or school-based technology training. This training is more specific to curriculum, instruction, and classroom management. It is also a key step in integrating technology into these areas.

Curriculum, instruction and classroom management. Principals and teachers were asked what emphasis was given to several areas of technology training in their schools (see Table 10.) The greatest emphasis in technology training was on basic computer operations, and on curriculum use of technology to create learning opportunities for students. Principals were a little more likely than were teachers to indicate that technology-training opportunities had been emphasized in the school during the past year.

Table 10. Principals' and Teachers' Ratings of Emphasis on Technology Training in Their Schools

Area of Training	Principal Ratings		Teacher Ratings	
	Substantial Emphasis	Moderate Emphasis	Very Much	(Moderate Emphasis)
Basic computer operations (including Internet applications)	54%	34%	38%	37%
Curriculum and instructional applications of technology use[a]	–	–	26%	38%
Using technology to create unique learning opportunities for students	39%	40%	25%	37%
Using technology to create educational contexts in which students take on a more independent role in their learning	26%	37%	17%	35%
Using technology to participate in professional networks and advance your own practice	25%	34%	12%	28%
Advanced telecommunications, such as creating a Web page or setting up distance-learning opportunities[a]	–	–	8%	18%

[a] Question asked only on teacher survey

Training to use technology to affect classroom management was also addressed. When asked if emphasis was placed on training to use technology to create situations in which students take a more independent role in their own learning, again a majority of principals (79 percent) and teachers (52 percent) indicated moderate-to-substantial emphasis.

On the principal survey—but not the teacher survey—there was a tendency for suburban schools to be more highly rated as emphasizing training in all areas surveyed. This seems to continue the pattern of suburban schools being further along in implementing technology in the curriculum.

Professional practice and collegiality. Finally, technology can have a great impact on opportunities for teachers to develop professional collegiality as well as advance their own practices. When fluency and resources allow access to e-mail and the Internet, opportunities for professional interaction with colleagues and an abundance of resources become available. When asked what emphasis has been placed on training teachers to use technology in this way, 25 percent of principals and 12 percent of teachers indicated substantial emphasis had been placed on training in this area (see Table 10.)

Dimension 4: System Capacity

The educational system includes legal, organizational, and social elements that extend from the legislative-policy level to the classroom level. The educational system defines roles for every participant in the system, the means they can use in fulfilling their roles, and the goals they should be seeking to achieve. Many commentators on educational reform have noted that our existing educational system was designed to meet the needs of agrarian, and then industrial, economies, while we are now living in the age of information. This section asks, "Is the Virginia educational system reengineering itself to meet the needs of learners in a knowledge-based global society?"

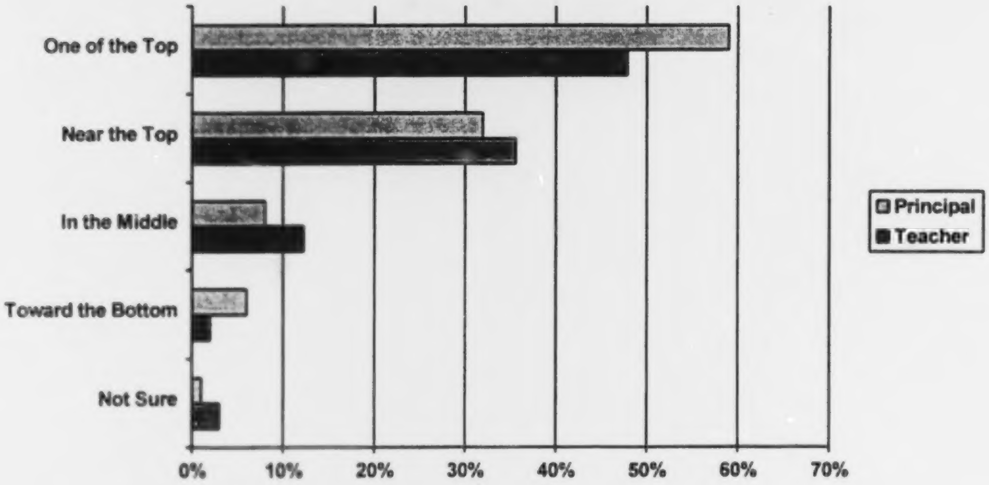
Vision

A vision of technology in schools should be based on the value it brings to children in grades K-12 as well as the value that we place on technology in general. If the stakeholders feel that it is important, then the costs of all kinds will be borne in order to make it successful. As an example of one stakeholder group, a national survey asked 810 registered voters how important it was to them to provide public schools with access to computers. The results are as follows:

- 26 percent "one of the top few priorities"
- 34 percent "near the top of the list of priorities"
- 31 percent "in the middle of the list of priorities"
- 8 percent "toward the bottom of the list of priorities"
- 1 percent "not sure"

When this same question was asked of Virginia's principals, many answered as strong proponents of technology use in schools. Teachers were also more favorable toward technology than were the above-mentioned voters.

Figure 10. Principals' and Teachers' Ratings of the Priority of Providing Public Schools with Access to Computers



A vision of technology being used in education, or education transformed by technology, is a multi-faceted thing. One of the first—and most important—steps in producing such systemic change is creating a vision of desired outcomes. It asks, "What would it be like if technology were effectively and broadly used in public schools?" Such a vision should describe a story of effective use and outcomes. It should also include a cognitive, rational analysis outlining the steps required to produce those outcomes—"how to get from here to there."

As important as vision is, from the very beginning of any program the focus must be on implementation. Indeed, many a good idea or program has floundered because of poor implementation. Implementing technology in the lives of students and teachers requires leadership; planning; equipment; software; building space and preparation; staff training and support; and development of instructional materials for students and teachers. If a technology program is to succeed it must have vision and focus, a purpose and a plan, and a thorough implementation.

Leadership and planning

Good planning involves good leadership in terms of bringing ideas from all audiences to the table and then balancing the issues and concerns of those audiences with the resources that are or could be made available. Planning has happened in Virginia; all Virginia school divisions have completed a technology plan and submitted it to the Virginia Department of Education. Such division plans should be accessible to all principals for their own planning and implementation, especially the management of information such as costs and budgets.

Most, but not all, schools have made their own technology plans. Principals were asked in their surveys if their *school* had a school-level technology plan: three-fourths (76 percent) said "yes". The urban and suburban schools are more likely to have technology plans than are their rural counterparts (79 percent urban, 80 percent suburban, 67 percent rural).

Technology in these educational settings is expected to be used for educational purposes, of course. As part of planning for technology, there should be a strong expectation that technology will be used for educational purposes by both students and staff, and agreements should be put in place in case questions about use should arise. Most schools (89 percent) do have written policies for students regarding the appropriate use of technology. (Suburban schools were a little more likely to have established boundaries for student use of technology—94 percent, compared to 84 percent for urban. Rural schools fell in between them—87 percent.) In addition, three-fourths of the schools (72 percent) have written policies for teachers that delineate appropriate use of equipment and software.

Incentives for professional use

We asked principals what incentives their schools or divisions have used to encourage teachers to use technology as part of their instructional activities. The most commonly selected answers involved implementation of what appear to be low cost or regular programs for technology expenditures. Most encouragement came in the form of expectations or requirements of the teachers (65 percent), use of school technology over the summer (65 percent), resources for the media centers and classrooms (63 percent). Least used options included technology certification for training (30 percent), schedule changes to allow for collaborative planning among faculty (30 percent), and salary incentives (eight percent). Responses from teachers followed the same pattern.

More elementary- and middle- than secondary-school principals reported that teachers could use computers and other resources over the summer as incentives to promote technology (68 percent elementary, 67 percent middle, 56 percent secondary). Also used as incentives, particularly in elementary and middle schools, were special purchasing programs (49 percent elementary, 47 percent middle, 39 percent secondary) and schedule changes so that staff could collaborate for instruction and activities (32 percent elementary, 40 percent middle, 18 percent secondary).

Suburban and urban staffs are more likely than their rural counterparts to receive the use of school technology over the summer as an incentive for integrating technology (69 percent suburban, 67 percent urban, 59 percent rural). Suburban principals are more likely than either urban or rural principals to do the following to encourage their staffs in the use of technology: express high expectations for use (71 percent suburban, 59 percent urban, 62 percent rural); give funding for resources in classrooms and media centers (59 percent suburban, 45 percent urban, 49 percent rural); and give release time for planning (38 percent suburban, 32 percent urban, 26 percent rural).

Table 11. Incentives Used by Schools and Divisions to Encourage Use of Technologies

Incentives		
Technology-related resources approved for media centers and classrooms.	65%	75%
Expectation/requirement that professional staff use technology as a research and learning tool.	65%	72%
Use of school technology over the summer months.	63%	63%
Funding for classroom-based and media center technology resources	52%	59%
Special purchasing programs for computers/technology	46%	56%
Access to a technology-based administrative system for efficiencies	39%	40%
Technology certification for teachers who are trained in technology	30%	34%
Acknowledgment of effective teacher use of technology	39%	29%
Release time for planning the use of technology	32%	23%
Schedule changes so teachers have time to learn and plan collaboratively	30%	23%
Salary incentives for teachers seeking technology training	8%	8%

Middle and high school teachers are more likely to use software for keeping student records. Schedules that allow staff to collaborate on instruction are more common in elementary and middle schools than they are in high school, according to both principals and teachers. Teacher responses indicate that there is also a difference according to school location. Urban staffs reported most collaboration time; rural staffs had the least.

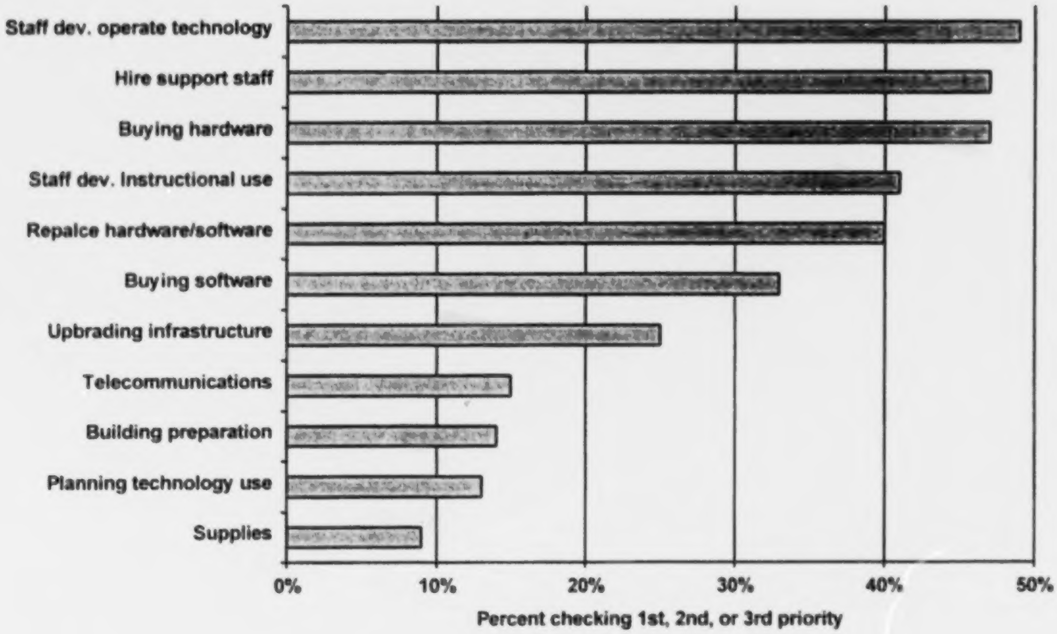
Ensuring capacity

Eighty percent of surveyed principals and more than half (54 percent) of the teachers feel the state is spending too little money on technology for instructional purposes. Although to a somewhat lesser degree—perhaps because of being less familiar with the specifics of school needs for computer funding—this perception of under-funded school technology is shared by 50 percent of a national sample of registered voters, 49 percent of a cross section of high-level business executives of U.S. companies, and 42 percent of state legislators and top legislative staff who are members of the Education or Appropriations committees in their respective states.

When asked how well state and local funding together could provide adequate funding to implement the school's technology plans, one-fourth of the principals (28 percent) answered "extremely well" or "well." Most principals said the combined funds would provide for their program only "fairly well" (43 percent) or "not well" (29 percent).

We also asked principals to indicate their top three priorities for any additional technology funding their school might receive. Ranking high on their lists are staff and hardware issues.

Figure 11. Top Three Priorities for Additional Technology Funding (Principal Survey)



There were no significant differences between groups regarding training staff for technology; one-half of all principals gave such training a high priority. There were, however, differences regarding training for *effective* classroom use (such as integration with course content). Urban principals were more likely to give importance to professional development for effective use (63 percent urban, 47 percent suburban, 38 percent rural).

Hiring technology support staff was a higher priority with suburban schools, perhaps because they are further along in adoption or have more likelihood of being able to afford it (34 percent urban, 57 percent suburban, 44 percent rural). Elementary school principals gave a higher priority to hiring staff for technological support than did secondary principals (51 percent elementary, 39 percent middle, 46 percent secondary). As mentioned below, elementary-school teachers rate themselves as having fewer computer skills than do their secondary counterparts.

Another difference between groups in these responses relates to hardware purchases. A few more urban school principals (54 percent) gave hardware purchases a high priority for any possible spending than did principals in suburban (44 percent) or rural (45 percent) schools.

Most, but *not* all, of the school buildings in the state, in terms of basic systems such as power, ventilation, and security, are apparently adequate for anticipated technology setups. An average of 14 percent of principals at any grade level indicated that their buildings needed such basic improvements. The buildings that do need basic systems updating are mostly urban (23 percent), followed by rural (16 percent); and finally suburban (eight percent).

Updating buildings for technology with wiring, lighting and installing networks is a priority for many schools in the state. Such changes in the infrastructure of the building are much more in demand for inner city (39 percent gave these changes a high priority) than they are for rural schools (25 percent) or, as would be expected, for suburban schools (17 percent). There is little difference between grade levels regarding the priority for wiring and other upgrades—about one in four gave such changes a high priority regardless of grade level (26 percent to 22 percent). It is a little more likely to be an issue in schools classified as "other" (33 percent).

Telecommunications are a budgeting priority for only 15 percent of all principals. They were more often mentioned as a spending priority by rural school principals than they were by either urban or suburban school principals (22 percent rural, 15 percent urban, 9 percent suburban). Priority rankings were similar between grade levels. As discussed below, only half of the schools have telecommunications available to them.

Giving training and support

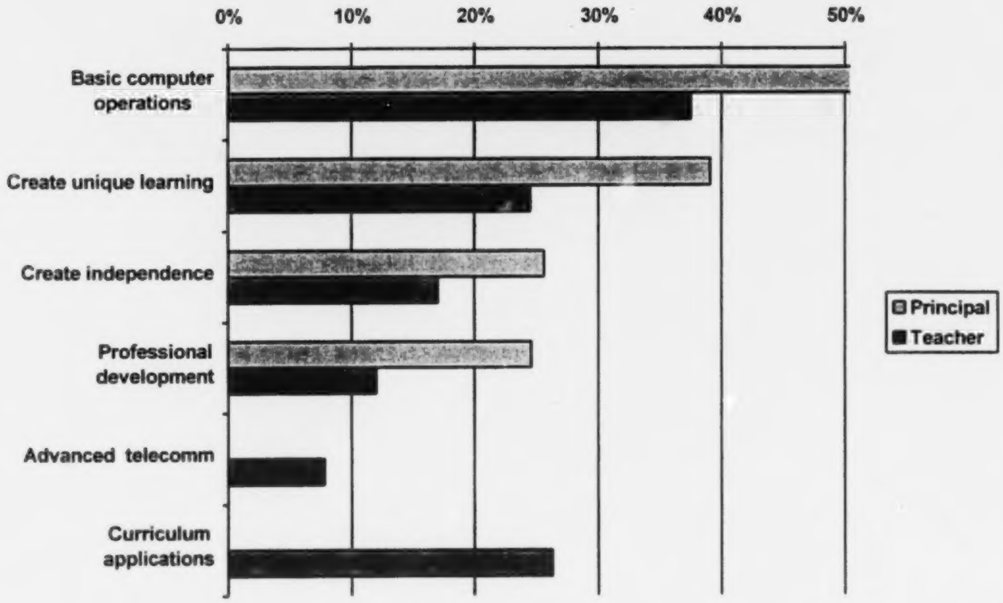
We asked principals how much emphasis there was on four areas of technology training the 1997-98 school year. Teachers were asked about the same four areas and two additional skill areas; they were also asked to rate their own resulting skill levels in each area of training. All of these answers suggest that many teachers are involved in the earlier stages of adoption of computer technology, and a still substantial, but somewhat smaller, number of teachers is at the level of transforming their instruction with technology.

About half of the principals (54 percent) said that "substantial emphasis" was given to basic computer operations; more suburban and rural principals (56 percent, 60 percent) reported strong emphasis on basic computer operations than did urban principals (43 percent). Four out of 10 principals (39 percent) gave substantial emphasis to technology use for creating unique learning opportunities for students. One-fourth of the principals said that substantial emphasis was given to two other areas of training: using technology to create educational contexts in which students take a more independent role in their own learning (26 percent); and using technology to participate in professional networks to advance their own practice (25 percent).

The teacher ratings for emphasis were a little lower in all categories than were the principal ratings, but the pattern was generally the same for the categories. The largest proportion of teachers said there was "very much" emphasis on training about basic computer operations (38 percent). About one-fourth of the respondents said that strong emphasis was placed on curriculum and instructional applications of technology use (26 percent) and on using technology to create unique learning opportunities (25 percent). Fewer teachers received a high amount of emphasis on using technology to create educational contexts in which students take on a more independent role in their learning (17 percent), participation in professional networks (12 percent), and advanced telecommunications, such as creating Web pages (eight percent).

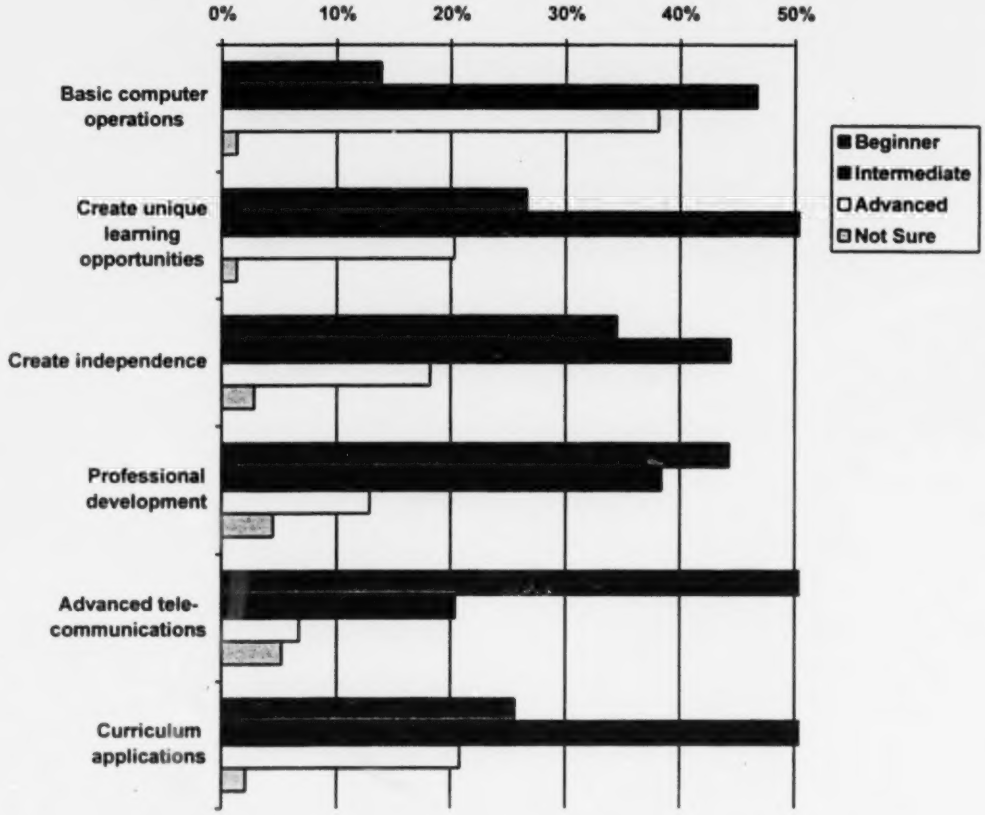
More elementary and middle school teachers reported the highest category of emphasis on using technology to create unique learning opportunities and to create contexts for student independence. About 10 percent fewer secondary-school teachers reported such emphasis in these areas (unique: 25 percent elementary, 30 percent middle, 20 percent secondary; independent: 20 percent elementary, 19 percent middle, 10 percent secondary).

Figure 12. Areas of Emphasis for Technology Training in the 1997-98 School Year Reported by Principals and Teachers



Teachers were also asked to rate their skill levels in the six areas previously discussed, according to three levels: beginner, intermediate, or advanced. In four of the six areas the majority of teachers rated themselves as "intermediate" in their skills, i.e., they have some experience and skill but are not experts or able to answer a broad variety of questions. In the areas of using technology for participating in professional networks and in advanced telecommunications, the majority of respondents said they were "beginners." In both basic computer operations and curriculum application ratings, the elementary teachers were about 10 percent lower than middle or secondary teachers in the "advanced" category.

Figure 13. Teacher Skill Levels After Technology Training in the 1997-98 School Year-Reported by Teachers



We also asked principals and teachers whether seven specific kinds of training and support were offered to them during the year and whether they used these resources. In addition to informal self-help activities, which almost everyone (97 percent) engenders, several types of technology training and support are available in many schools.

Virtually every one of the principals and teachers have access to and have used topic or skill-oriented workshops and seminars (93 percent principals, 89 percent teachers). The next most frequently available source of training and support was help-desk technical support provided by the division or an in-school specialist. Most of the principals (86 percent) said help desks have been available to them and most have used them (84 percent).

Collaborative teams receive a lot of press, in general, as being a type of leadership strategy that involves constituents and thereby encourages them to "buy in" to a program. In spite of that, fewer than two-thirds of the principals said that such groups were available to them (62 percent) or used (57 percent).

The Virginia Department of Education, regional consortiums, and telecommunications services (e.g., distance learning) were used less often than other choices, even when available.

Table 12. Availability and Use of Technology Training and Support

Types of Technology Training and Support	Principal Ratings		Teacher Ratings	
	Training Was Used	Training Was Available	Training Was Used	Training Was Available
Informal, self-taught, as time allows	97%	96%	96%	94%
Formal workshops/seminars that are lead by experts with a focus on one topic or skill	95%	93%	92%	89%
Help-desk technical support provided by the division, in-school specialists, or others.	86%	84%	83%	79%
Development of collaborative teams of teachers and others who solve problems, make decisions, prepare lessons	62%	57%	54%	50%
Regional consortiums	56%	41%	50%	26%
Telecommunications (e.g., distance learning)	52%	34%	46%	22%
Virginia State Department of Education	58%	34%	44%	24%

Principals and teachers were also asked to rate the usefulness of the training and support they were offered and given. Responses were given, whether or not these professionals had the options offered or used by them during the school year under discussion. The following discussion and figure are arranged in descending order, beginning with the most popular option.

Workshops and seminars have the most favorable rating from both principals and teachers. They were rated by 81 percent of all of the principals, and 71 percent of all teachers, as being "very effective" or "effective". About 18 percent of the principals and 23 percent of the teachers said that they were "somewhat effective."

The self-help approach is common and approximately two-thirds of the professionals say that it works; however, faculty members training each other or themselves apparently has deficits. A large number of principals (40 percent) rated this method as only "somewhat effective". (Only a few, three percent, said self-help is "not effective"). Likewise, one-third of all teachers also rated it as "somewhat effective".

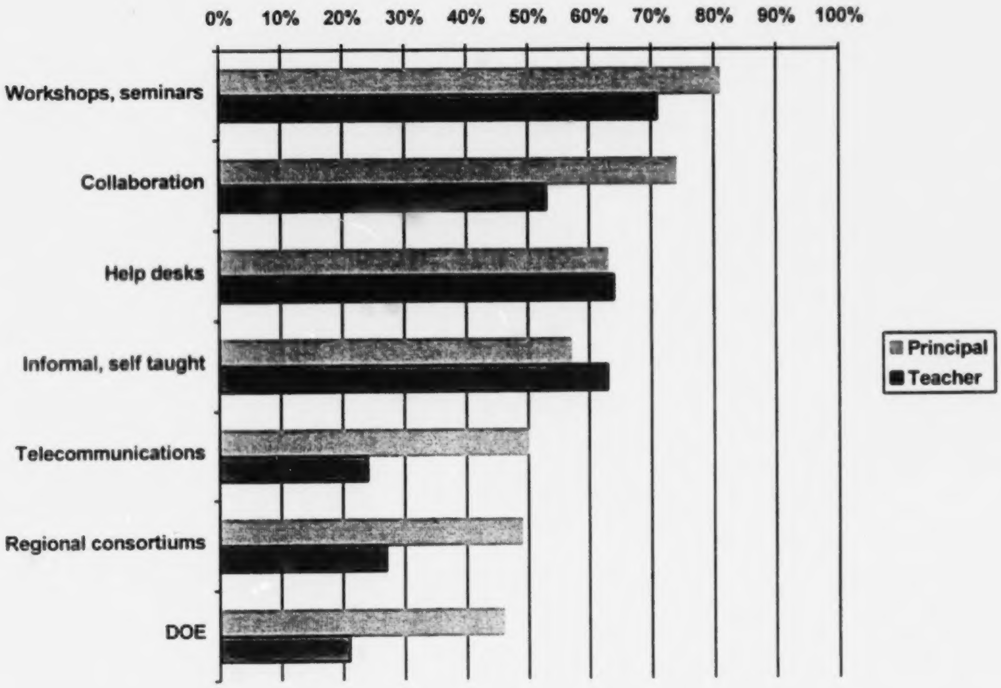
When help-desks of various kinds were judged as a group, two-thirds of both principals and teachers (63 percent, 64 percent)) rated them as "very effective" or "effective". However, three in ten principals and two in ten teachers (30 percent, 21 percent) said that they were only "somewhat effective".

Collaboration between staff members was judged differently by principals and teachers. Three-fourths of principals (74 percent) said that collaborative efforts were effective, while only one-half of all teachers (53 percent) agreed. About 21 percent of all principals and 16 percent of all teachers said that such groups were only somewhat effective.

The last three options—regional consortiums, the offerings of the Virginia State Department of Education, and telecommunications such as distance learning—are perceived as being less effective than other types of training and support. They are also less familiar to teachers. Roughly one-half of the principals and teachers reported having such options being available to them, and one-half or more of that group took advantage of the offers. About one-half of the principals rated these options as being effective, while only one-fourth of the teachers did. However, one-half of the teachers were unsure about the value of these three options, indicating that they may have had limited familiarity with them.

Numbers were also examined for differences between groups of respondents: those who had options available and then did or did not use them, and those who did *not* have options available. In general, those principals and teachers who had options available, but did not use them, gave low effectiveness ratings for those options. In other words, options were less likely to be used when professionals thought they were not very helpful.

Figure 14. Training and Support Rated as Very Effective or Effective



Dimension 5: Community Connections

Schools and communities can work independently of each other, and often do, but this is changing in many places as schools begin to function again as "community centers." Strong connections between the two can provide benefits to both schools and communities in very direct ways. Technology, in particular, can create potential connections between schools and communities by making communication between the two easier, in the form of e-mail and on-line access. Technology also provides incentives for more involvement, as both acquire, need, and vie for limited resources. Schools and communities could look at each other as potentially interdependent sources of strength and need, and in some communities this is happening.

Because of the expenses of technology, schools feel great need in comparison to educational materials of yesteryear. This need has forced some schools to look outside their buildings to resources in the community—for funding, equipment, software, materials and personnel with skills and the willingness to be involved in the schools. In turn, schools are sometimes in a position to offer such resources to the community.

The community also has interests, both as giver and as receiver. Citizens of all ages understand that technology is important and want children to be educated for the workplace and leadership roles of tomorrow. Some parents and other citizens would like to be involved in policy decisions in their local schools, including technology decisions. Companies have offered equipment and supplies; citizens have volunteered to teach, tutor, and help with equipment. On the receiving end, some adults want technology training for themselves and access to equipment that is convenient and inexpensive—things that some schools can offer.

Commitment

In spite of the mutual needs and interests of the schools and their communities, and despite the fact that schools and communities are all made of up families and children, a strong relationship requires a lot of effort to develop. In Virginia, one-half of the principals said that the community played a role in shaping their school's vision for technology. That is a significant finding. When the community is involved in the underpinnings of how the schools work, and what the school values will be, the community is likely to be more supportive of all aspects of local schooling.

Most involvement with schools comes from people who are already involved with the school, however. Two-thirds of the principals said that parents, teachers, or student organizations were moderately or very involved in promoting or enhancing the use of technology in their schools. Only one-third said that business groups were involved in their schools. One in four reported the involvement of a local post-secondary school.

There are two types of schools that have maximum parental involvement: elementary schools and schools in suburban areas. Parents tend to be more involved at the elementary level, when children are young and schools are small. As children mature and want independence, and as more teachers are involved in each child's life, the connections between schools and parents become fewer and weaker. Teachers seldom call home; parents seldom call school, except in unusual circumstances. Whether using the rating of "very involved" by itself, or using it along with "moderately involved", elementary schools numbers show significantly more involvement from parent, teacher, or student organizations than do secondary schools or middle schools.

Parents are also more involved in suburban schools, where, apparently, economics makes a difference. Parents who have had relatively more success in school themselves, and perhaps participated in more extracurricular school activities as young people, are more prepared and more likely to find a place for themselves in the schools.

Even as high schools have less involvement from parent groups, however, more interest comes from other sectors. Local post-secondary institutions are noticeably more involved in secondary schools than they are in middle schools or in elementary schools in particular (42 percent compared to 28 percent and 16 percent). They are also more involved in schools located in urban and rural areas.

Few schools stated that business groups were "very involved"; for all grade levels the average was 12 percent. The "moderately involved" rating, however, indicates a somewhat higher level of involvement in secondary schools when compared with elementary and middle schools (moderate involvement: 35 percent elementary, 34 percent middle, 46 percent secondary). Principals and teachers gave similar ratings for involvement, with the exception that principals were a little more positive about parent involvement than were the teachers.

Table 13. Involvement of Community Groups in Technology Use by School Level

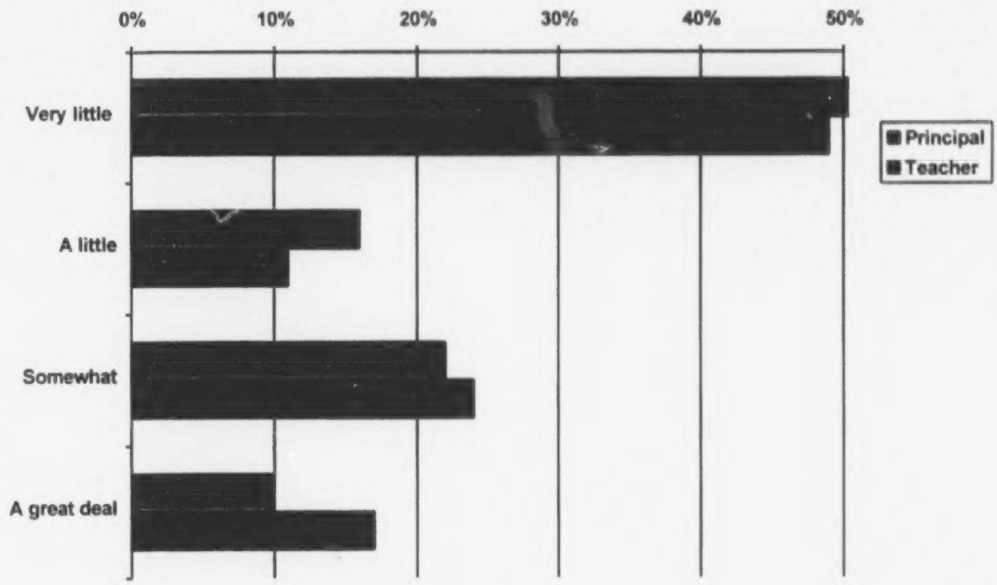
Groups	Total State	Level of School			School Community Type		
		Elem.	Mid.	Sec.	Urban	Suburb	Rural
Principals							
Parent, teacher, or student organizations	65%	72%	65%	44%	61%	73%	58%
Business groups	36%	33%	38%	46%	35%	35%	38%
Local post-secondary institutions	23%	18%	25%	41%	18%	16%	35%
Teachers							
Parent, teacher, or student organizations	64%	65%	49%	45%	49%	65%	49%
Business groups	35%	35%	34%	46%	35%	41%	36%
Local post-secondary institutions	22%	16%	28%	42%	21%	26%	33%

Collaboration

Principals were asked to report what role their communities played in shaping their schools' vision for technology. Most principals—about 58 percent—said that their communities did play a role in planning for the school's technology program, either a moderate or major role. There were no differences between grade levels of these schools, the communities were involved in all of them alike. There was a small difference according to locality; suburban schools were a little more likely to report community involvement (65 percent suburban, 52 percent urban, 54 percent rural). One-third of the principals (33 percent) said that the community's part was minor, and only nine percent said that the community was not involved at all.

Taken together, the schools are not very likely to see themselves as being on the giving end, i.e., contributing technology to their communities. About one-half of the principals and teachers said that their schools contributed very little to the communities in which they were located. Approximately one-fourth (22 percent principals, 24 percent teachers) said they contributed "somewhat", and a small number said that their schools contributed a great deal of technology-based resources and services to benefit the community (10 percent principals, 17 percent teachers). There were no differences between locations for this issue, according to principal results. However, secondary schools were nearly twice as likely to say they donated to the communities as the elementary schools (with middle schools falling between them).

Figure 15. The Extent to Which Schools Offer Their Communities Technology-based Resources and Services



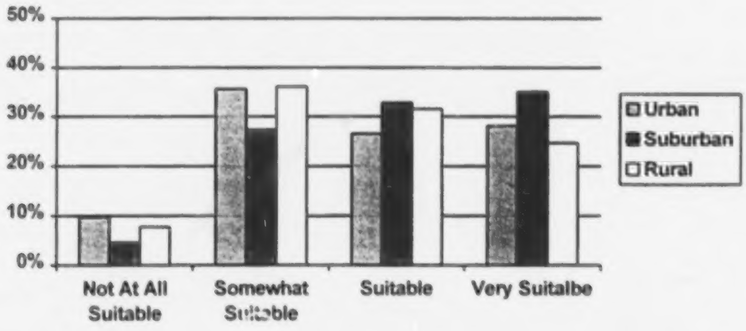
Dimension 6: Technology Capacity

There are many components to successful use of technology in education. Key staff members must sign on, faculty and staff require appropriate training, use of technology must be woven into curriculum. These are issues already discussed in this report. However, without establishing the hardware capacity to use technology, these preparations can be ineffectual. This includes buildings that are technology ready, (e.g., available space, adequate power, available Internet wiring), hardware and software which is accessible to teachers, and a technical support staff. This dimension is fundamental to the successful implementation of technology plans.

Facilities

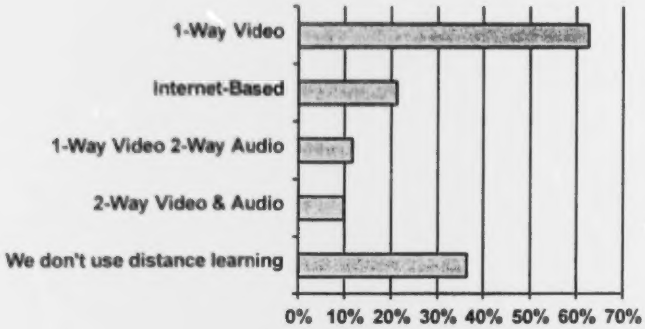
To begin with an overview of facilities, principals were asked to rate the suitability of their school building for using instructional technology (e.g., space for computers, ease of wiring, lighting, ventilation, security). Only 61 percent of principals rated their schools as "very suitable" or "suitable". Thirty-nine percent rated their schools as "somewhat suitable" or "not suitable". When considering suitability of buildings across location of school, not surprisingly, more suburban (68 percent) than rural (57 percent) schools were rated as suitable. As on many other measures, it appears that suburban schools have a more adequately funded and implemented technology program.

Figure 16. Principal Ratings of How Suitable Schools are for Using Instructional Technology



From here, survey questions delved into areas of building suitability specific to connectivity. Principals were asked what capabilities their schools have in receiving and/or transmitting live or delayed instruction from a distance. Nearly two-thirds (63 percent) reported one-way video and audio capabilities (cable television, satellite dish). Less than one-fourth (21 percent) of the respondents reported Internet-based distance learning capabilities. Only 12 percent reported one-way and two-way audio and video capabilities; 10 percent reported full two-way video conferencing capability. Finally, 37 percent reported that no distance learning occurs in their school.

Figure 17. Percent of Distance Learning Technologies in Schools (Principal Survey)

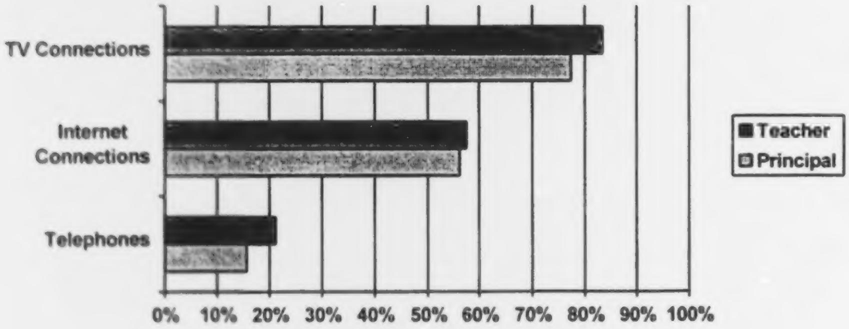


Differences in distance learning capabilities across level of school can most readily be summarized by looking at differences in who does and does not use distance learning. For level of school, significantly more elementary- (39 percent) and middle-school principals (32 percent) reported *not* using distance learning than secondary (21 percent).

Classrooms and other instructional rooms

Principals and teachers were asked what percentage of classrooms and other instructional rooms are equipped with telephones, computers connected to the Internet, and TV monitors with cable or antenna feeds. Figure 18 illustrates the average percentage of equipped classrooms for all schools. Televisions with cable or antenna are most prevalent. Over half the schools have one or more classes with Internet access. Far fewer classrooms have telephones available. Principals indicated other instructional rooms have a similar pattern of technology connectivity, with the greatest percentage having television (69 percent). Internet connectivity was next (60 percent), followed by telephones (37 percent).

Figure 18. Percent of Classrooms with Telephones, Internet Connections, and TV Connections



Principals describe substantial differences between urban, suburban and rural schools on connection to the Internet. Suburban principals reported about three-fourths of their classrooms (75 percent) and other instructional rooms (73 percent) were connected to the Internet. This compares with urban and rural principals reporting thirty-six and forty-six percent respectively for classrooms; forty-eight and fifty-two percent for other instructional rooms respectively. Elementary and middle schools were also somewhat more likely to have classroom Internet connections than secondary schools (58 percent elementary, 57 percent middle, 48 percent secondary). There was also a modest tendency for suburban schools and to also report telephones in the classrooms compared to urban or rural schools.

Workstation connectivity

Principals and teachers were asked to list the number of computers in different locations of their buildings (classrooms, computer labs, media centers, and administrative/counselor offices). They were also asked how many of these computers were connected to the Internet, either by modem or high-speed network. From these data, the proportion of computers connected to the Internet was computed across location, providing another view of school connectivity. On average, principals reported forty-eight percent of the computers in the schools connected to the Internet; teacher reported that forty-nine percent of the computers in their classrooms were connected to the Internet. About half of computers in labs and classrooms are connected to the Internet while over ninety percent of the computers in media centers and administrative and counseling offices are connected.

Installed Base/Average Number of Computers by Location

The different facilities just discussed, particularly connectivity, comprise the infrastructure for the use of technology in education. Hardware and software must also be accessible to teachers. We asked principals to report on the accessibility of computers of various capabilities within computer labs, classrooms, and media centers. The average number of students per computer in each area of the school was then computed. Within Virginia schools, there is an average of 12.5 students per modern computer. A modern computer was defined as a PC 486 or better or Mac LCIII or better. These are computers capable of running up-to-date applications for learning and teaching. For this reason, state and division goals for providing access to computers might more usefully be stated in terms of the ratio of students to modern computers, and not just students to any type of computer.

There are about 11 students per multimedia computer and per computer connected to a local area network within the school. For every computer capable of accessing the Internet there is an average of ten students in school who might use it. When we consider all types of computers—modern computers, early-generation PC and Apple, there are about five students per computer.

The most accessible location for computers in Commonwealth schools is in the classroom. The average number of classroom computers as reported by teachers was 4.1 machines per room. Fifty-five percent of teachers said they had access at school to a computer in the classroom or office at school. (As a side note, 70 percent of teachers said they owned a computer with modem at home, another 14 percent had a computer but no modem, and 15 percent had no computer. Of those who owned a computer with modem, 57 percent used it to connect to an online Internet service daily or almost daily, and another 21 percent did this at least once a week.)

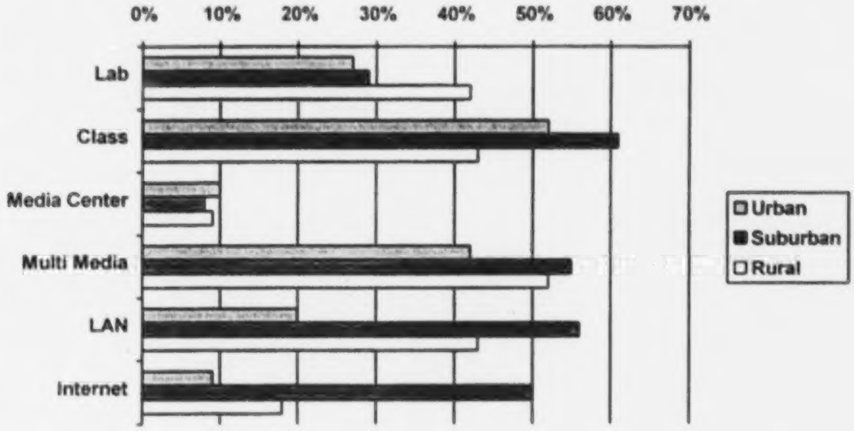
Table 14. Mean Number of Students per Computer by Location (Principal Survey)

Type of Computer	Mean Number of Students per Computer			
	Computer Lab	Class	Media Center	All School Areas
Modern Computer (PC—486 or better or Mac—LCIII or better)	20.1	13.8	68.8	12.5
Multimedia Computer	30.3	20.2	105.4	10.9
Computer connected to a Local Area Network	29.0	20.4	96.9	10.7
Computer connected to the Internet by modem or high speed line	30.0	19.1	56.2	9.7
Total of all instructional computers	15.2	10.0	55.3	5.4

Elementary schools tend to have a greater percentage of computers in classrooms, while middle and secondary schools tend to have more in computer labs. In elementary schools over one-half (59 percent) of the computers are in classrooms and less than one-third (29 percent) of the computers are in labs. In middle schools, the ratios are nearly even (45 percent class, 44 percent lab). In secondary schools one-half (49 percent) of the computers are in labs and around one-third are in classrooms (39 percent). About one-tenth of the computers (12 percent elementary, 11 percent middle, 12 percent secondary) are in the media center. Elementary schools tended to have computers less connected to local area networks (46 percent elementary, 52 percent middle, 65 percent secondary). Elementary schools also tend to have lower connection rates to the Internet than the higher grades (24 percent median elementary, 42 percent median middle, 30 percent median secondary).

When we compare urban, suburban, and rural schools, suburban schools tend to have a higher percentage of class computers and multimedia capable computers. However, suburban schools are much more likely to have computers connected through a local area network (LAN) and to the Internet.

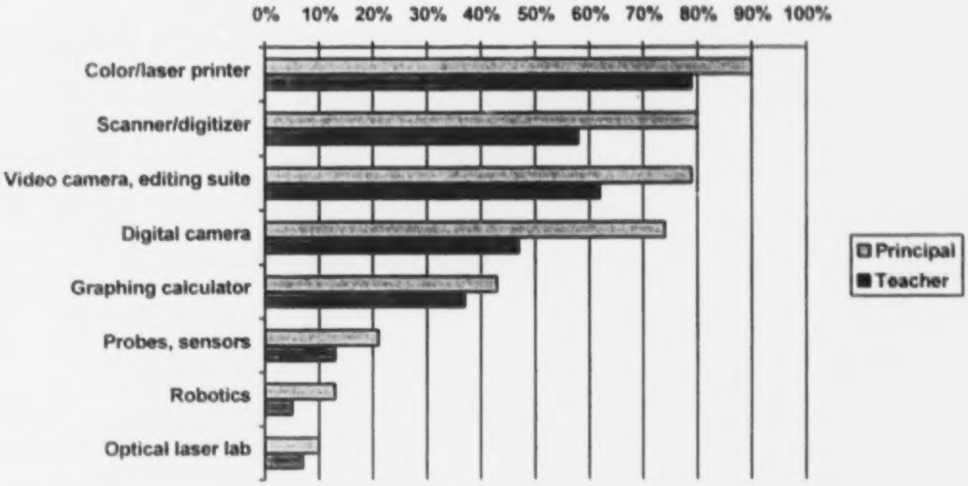
Figure 19. Percent of Urban, Suburban, and Rural Schools with Different Computer Locations and Capabilities



Availability of additional equipment

We surveyed the availability of additional technology equipment. Equipment available in more than one-half of the schools included: color or laser printers (90 percent principals, 79 percent teachers); scanners/digitizers (80 percent principals, 58 percent teachers); video cameras, editing suite (79 percent principals, 62 percent teachers); and digital cameras (74 percent principals, 48 percent teachers).

Figure 20. Additional Equipment Available in Schools



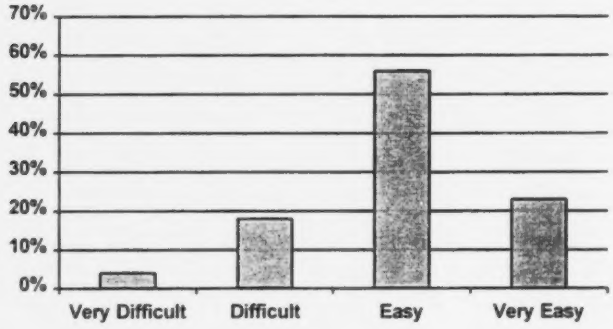
Suburban schools tended to have greater quantities of other technology equipment than rural schools, urban schools, or both. For example, according to the principal survey, scanners/digitizers were more available in suburban schools than urban or rural (87 percent suburban, 76 percent urban, 74 percent rural.)

For level of school, a consistent pattern emerged. For most types of equipment surveyed middle and secondary schools did not differ, but in all cases the equipment was significantly more available than in elementary schools. Given the advanced nature of much of this equipment, this finding is not surprising.

We asked teachers how well defined the procedure is in their school for accessing media center or computer lab equipment. Almost all said it was "very well defined" (54 percent) or "moderately well defined" (37 percent).

We also asked teachers how easy it is, in general, to access the technology they need in their school. Teachers were somewhat less positive in answering this question. Nearly one in five (22 percent) said it was "difficult" or "very difficult".

Figure 21. Teacher Ratings of How Easy it is to Access Technology in Their School



Technical support

We asked principals several questions about the technical support available to teachers. For an overall picture, 56 percent reported having a staff member who has at least 20 percent FTE (about eight hours a week) assigned to supporting teachers' use of instructional technology. Stark but predictable differences emerged across both location of school and level of school. For location, significantly more suburban principals than both urban and rural reported having a staff member providing technical support (71 percent suburban, 55 percent urban, and 38 percent rural.) For level of school, significantly fewer elementary school principals than both middle and secondary school principals reported having this level of technical support in their school (55 percent elementary, 66 percent middle, 62 percent secondary.)

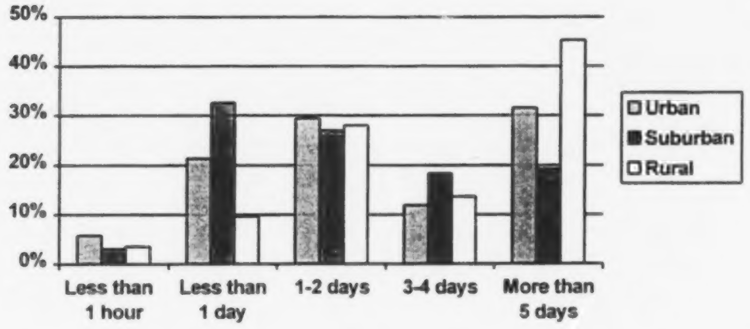
Principals were also asked about the availability of division-level support specialists for hardware, software, and network problems. The highest level of support was for hardware and networking, and somewhat less for software use. As seen before, significantly more suburban and urban principals reported receiving all kinds of division support than rural. On this, urban schools did not differ significantly from suburban schools.

Table 15. Sources of Technical Support (Principal Survey)

Source of Support	Percent Checking Each Option		
	Hardware	**Network**	**Software**
Division-level specialist	88%	84%	75%
School-level support specialist	57%	50%	60%
Technical help-desk	39%	37%	33%
Online e-mail or Web-based support	34%	37%	32%
Online end-user training	11%	13%	14%

When teachers were asked how long it typically took to get assistance when technology broke down in their classroom, about one-quarter (27 percent) said one day or less, and another one-quarter (28 percent) said one to two days. As with other resource-intensive technology issues, suburban schools were more likely to report faster levels of technology assistance than rural schools, and to a lesser degree urban schools, as indicated in Figure 22.

Figure 22. Teacher Ratings of How Long it Takes to Get Technical Support



Dimension 7: Accountability

Accountability is important for strengthening any program. Activities for verifying accountability assure that outcomes will be noticed—whether or not there are attached consequences. Accountability measures also study program implementation and thereby encourage the efforts of participants.

It may seem evident that an educational program should be measured by its outcomes, but such measurement does not always happen. At the very beginning of any program, desirable outcomes should be planned to include student development in several dimensions, including skills and attitudes; in this process, outcomes become part of planning, development and implementation of a program. Once the program is implemented, desired outcomes become a key part of assessing the worth of a program.

Accountability can also encourage awareness of program development and the process by which a program is implemented. Accountability requirements usually promote the gathering of information that is useful in many ways, including focusing attention on implementation as well as outcomes. When outcomes are not as impressive as had been hoped, a knowledge of where and why things went wrong can help guide program reform. When outcomes imply that a program has been successful, there are many reasons to inquire what made a difference: to replicate the success in other programs; to continue support of the pieces that made a difference; to confirm that yes, indeed, the efforts expended were justifiable and worthwhile.

Any educational program benefits from accountability among its participants. Leaders, teachers, and students alike should be accountable for its success. The purpose of this is to encourage maximum involvement and working for goals and should always be handled in a positive way.

Deliverables and benchmarks

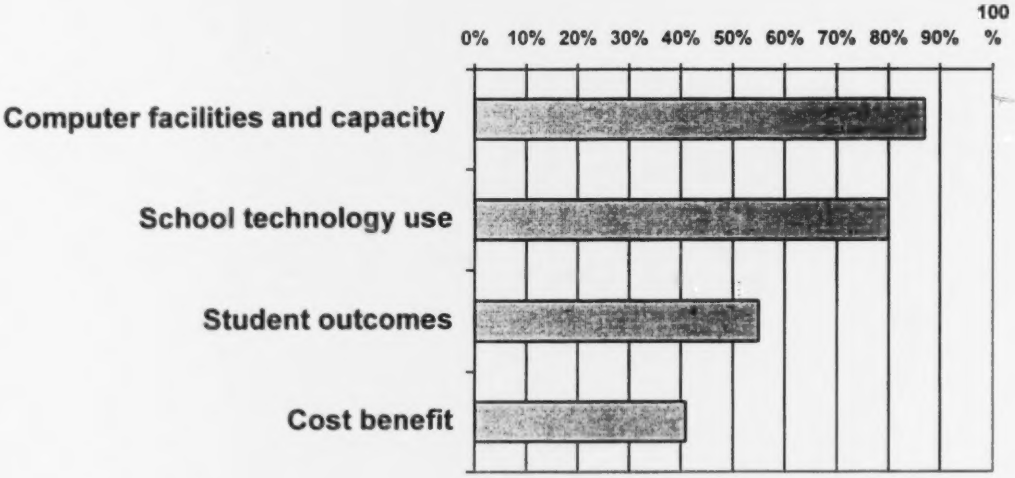
Along with its usefulness to program design and development, accountability is quite naturally expected after big outlays of financial support. The funding agencies want to know what they got in return for their investment; other audiences also want to know what was gained from expended effort and opportunity costs. In the case of funding technology in the schools, the question of accountability has been addressed in the past by providing lists of equipment, software and supplies, along with numbers of hookups to the Internet and local area networks.

But in the 90's and beyond, investors—in the form of public and state agencies—want to look beyond the purchases to the end-result of their investment. They want to know the differences such investments have made in the activities and experiences of students, and the technological training students have acquired in the process.

In this study, most of the principals said that their schools or divisions provided a great deal of information to the local school board or community regarding the status of technology. Most principals (87 percent) said that their schools or divisions gave inventory information regarding computer facilities and capacity. A large majority (80 percent) said that they gave qualitative information in the form of reports on program innovations, progress, and problems. There were no meaningful differences on these issues based on locale or grade level.

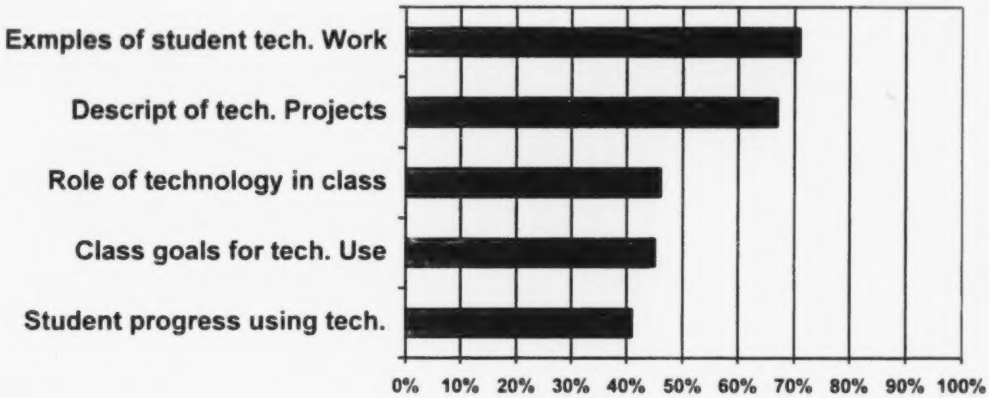
Student outcome or cost related information was less frequently cited as being a deliverable. Such information is not always required; it also takes more effort, expertise, and time to assemble. Still, about one-half of the principals (55 percent) said that they have given local school boards and communities information regarding student outcomes associated with technology. Fewer principals (41 percent) said that they have provided cost-benefit information. Other parts of this Virginia study indicate, however, that this information is most likely a first step for such reporting and not a true cost-benefit analysis.

Figure 23. Type of Technology Use Information Reported to Local Board and Community (Principal Survey)



We also asked teachers about the reporting of technology-related information to parents. Most teachers said that they gave parents examples of student computer work (71 percent) and descriptions of projects that used technology (67 percent). Fewer teachers explained to parents the role that technology plays in their classrooms (46 percent). It is interesting that fewer than half of the teachers (41 percent) give parents some kind of progress-report regarding their skills and use of technology. It is apparently not part of a routine report, at least not statewide.

Figure 24. Type of Technology Use Information Reported to Parents (Teacher Survey)



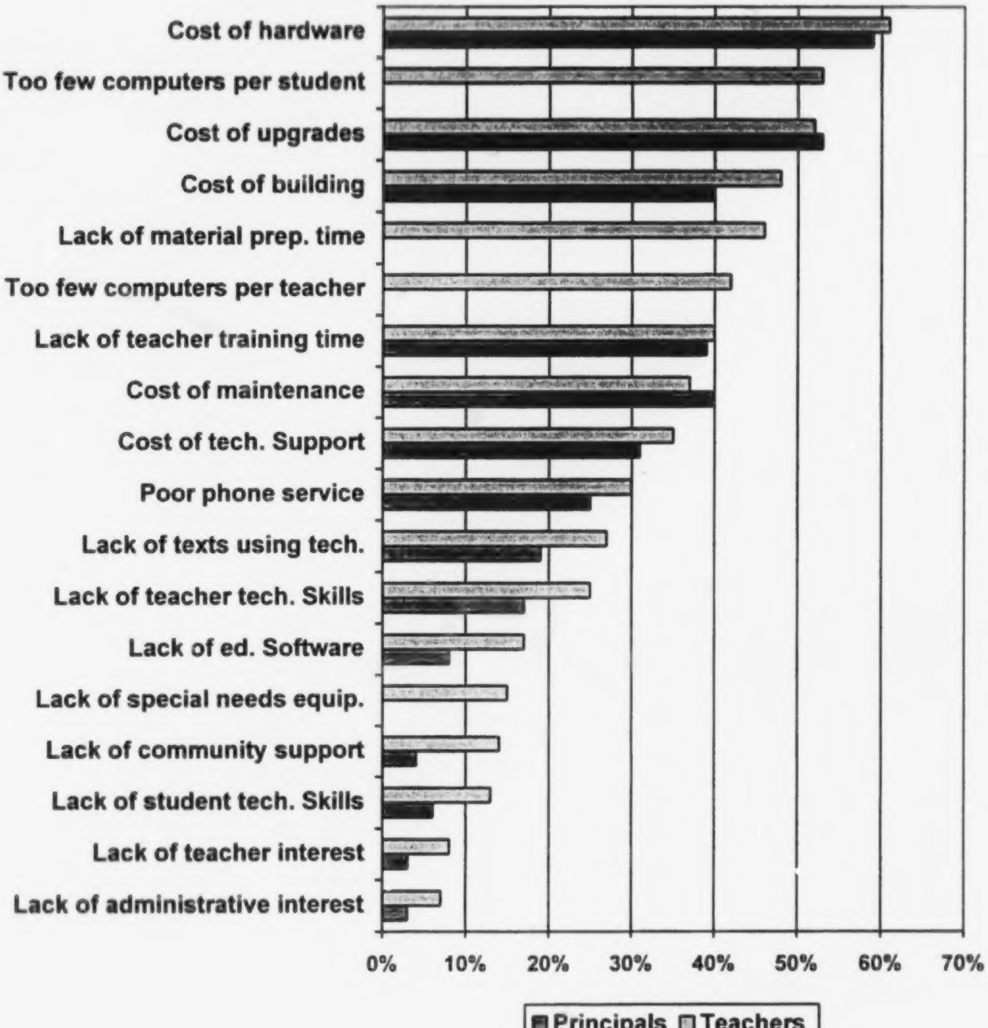
Data-driven decision making

Knowing what barriers there are to success can be useful in understanding the context in which a program has functioned. Such understanding can stimulate appreciation for accomplishments, as people succeed in spite of impediments. It can also highlight mediocre outcomes that can result in spite of empowerment. In either case, knowledge of significant barriers is an important part of understanding what elements of a program make a difference and which need shoring up. Such wisdom can ultimately provide guidance for planning program adjustments or for implementing new programs altogether.

The barriers noted as being "significant" by Virginia principals are primarily financial. (Indeed, even bargain technology is far more expensive than the educational materials of yesteryear.) The costs of hardware are most significant, and half of the teachers (53 percent) said that having too few computers available for students is a major problem for them. Fewer, but still many, teachers (42 percent) said that they themselves need more computer availability for their own tasks. The costs of upgrades, building preparation, and maintenance have had an impact on 40 percent to 50 percent of the principals and teachers.

Tangentially connected with money is lack of time for training teachers to use computers and technology (40 percent principals, 39 percent teachers). Elementary schools have a more difficult time finding time to train staff, but this is not surprising, since, among other things, they have a greater need for training and less negotiable time during the day. Almost half of the teachers (46 percent) also said that lack of time to prepare instructional materials for technology is a problem.

Figure 25. School-Level Barriers to Increased Use of Educational Technologies



Suburban principals were less likely to mention financial concerns across the board, no doubt because of their greater tax base. Rural principals were less likely to say that teacher training or providing support staff for technology was a significant barrier. This may indicate, when considered in light of other responses on the survey, that rural schools have been slower getting started with technology. They have thus not advanced sufficiently into the process for as many principals to realize a need for such support.

Most respondents did *not* say that lack of support from any segment of their community—teachers, administrators, board members, or community members—holds them back. One out of every five respondents did indicate that the lack of textbooks integrated with technology is a big problem; elementary principals were especially likely to note the problem (21 percent elementary, 13 percent middle, 14 percent secondary). This is a reflection of the fact that elementary grades have fewer technological materials—especially curriculum materials—available to them, especially for lower reading levels.

Communication

While the principals said that they had given their school boards and/or communities information regarding technology access and use in their schools, most of them did not receive useful feedback as a result. Not quite one in four (23 percent) said that they had received "a great deal" of feedback which could be incorporated into their schools' technology plans. One-third of them did say that they were given "some..." feedback, and one in four (27 percent) said that they had received little or no such feedback. (There were no differences between groups.)

School boards and communities could encourage such reporting by giving responses that recognize the efforts that schools are making and that are helpful to the school in accomplishing its primary mission. In the process, boards and communities would strengthen communication and become more involved in the values and directions of their schools.

Technology Access and Availability in Virginia Schools: Voices from the Field

Findings from Educator and Policymaker Focus Groups

Shannon Cahill, Ph.D.

As the Commonwealth continues to make funding decisions for technology in its schools, it is important that key stakeholders have a voice in these public policy decisions. Included here are the educators of children—teachers, administrators, support staff, parents, and community leaders. It is vital, when exploring the technology-education policy environment in Virginia, that we understand the perceptions, attitudes and opinions of these constituencies and learn from their experiences.

One of the most-effective avenues for understanding how people view complex issues is to go directly to the "source" by means of the focus-group technique. Focus groups facilitate a richer and deeper understanding of the issues under study and often provide the contextual background for understanding survey results. Gathering purposefully selected participants into small moderated group meetings encourages discussion in a semi-structured, permissive environment that nurtures the expression of different points of view without judgment or pressure to reach consensus.

Within the setting of the focus group, participants share and learn from each other. As the interviewer or moderator introduces various pre-defined topics, he/she encourages participants to go beyond "top-of-mind" thinking. It is for these reasons that the Virginia Department of Education utilized the focus-group research technique to round out the data-collection methods (survey, site visits, focus groups) used to obtain information about the availability and use of technology across Virginia schools.

Purpose of the Focus Groups

The purpose of the focus groups was to study discussions of current and emerging education technology policy issues from the *educator* perspective. In this case, the Virginia Department of Education sought to involve individuals from multiple populations—teachers and support staff, school administrators, and members of the Virginia Education Technology Advisory Committee (VETAC). In October 1998, 10 focus groups were held across all regions of the state. Approximately 140 educators from the elementary-, middle-, and high-school levels, as well as the policy arena, participated. (School Divisions represented are found in Appendix D).

Approximately 140 educators from the elementary-, middle-, and high-school levels, as well as the policy arena, participated. (School Divisions represented are found in Appendix D).

The focus groups provided a vehicle for building an in-depth understanding of educator perceptions of, and knowledge about, education technology practice and policy in Virginia. In addition, these focus groups provided a forum for educators to share their concerns *and* celebrations about technology in their schools, and to provide their own recommendations to the state in moving forward.

The Key Themes Addressed in the Focus-Group Sessions

The focus group study followed the guiding framework of the larger study overall, and the discussion protocol focused on the *Seven Dimensions for Gauging Progress*:

- *Learners*—Are learners using the technology in ways that deepen their understanding of the content in the academic standards and, at the same time, advance their knowledge of the world around them?
- *Learning Environments*—Is the learning environment designed to achieve high academic performance by students through the alignment of standards, research-proven learning practices and contemporary technology?
- *Professional Competency*—Is the educator fluent with technology and does he/she effectively use technology to the learning advantage of his/her students?
- *System Capacity*—Is the education system reengineering itself to systematically meet the needs of learners in this knowledge-based, global society?
- *Community Connections*—Is the school-community relationship one of trust and respect, and is this translating into mutually beneficial, sustainable partnerships in the area of learning technology?
- *Technology Capacity*—Are there adequate technology, networks, electronic resources and support to meet the education system's learning goals?
- *Accountability*—Is there agreement on what success with technology looks like? Are there measures in place to track progress and report results?

Discussions around these dimensions included recommendations to the state for moving forward. Key findings from the 10 focus-group sessions, thematically organized, are provided below. Please note that these focus groups represent only a snapshot of the educators and their experiences across the Commonwealth. Information provided is not intended to be generalizable, but rather to provide illustrations of experiences that can inform and enrich the survey data. The focus-group protocol is provided in the Methodology section of this report.

An Overview of the Responses by Focus-Group Participants: Along the Seven Dimensions of Progress

Summation of Discussion

As one principal summed up his feelings about the integration of technology in education: "It's the promise of what things we can do with technology and the fear of having to do it." Overall, the respondents across the focus groups recognized the potential of technology in learning. At the very minimum, they recognized that "technology" is not something that will "go away," it is not a "fad", and they asked that the state recognize that (in terms of continued support and funding). The overall tone was that while they had computers and some software—and believed that was a starting point—they were also frustrated with the lack of a "systems" approach to implementing the technology. They experienced disconnect between the technology they had and the training (or lack of) they received—training was not "just enough, just in time" but rather sporadic, lacked connections to their classrooms, and not enough. As one teacher expressed, "It's like we're being told to dig a ditch but not given a shovel." While to some extent they did look at themselves for the lack of technology use and integration—"We are our own worst enemies. We complain about having to return to school a week early and yet those days could be used to catch up on technology,"—they also understand their own limitations: "Technology has been thrown at teachers—computers, voice-mail, etc.—but we don't have the time or expertise to learn how to use it—or when to use it."

The general impression among these groups was that schools have started; they have some technology (but recognize it's only the beginning) and are anxious to "make it work." Barriers they face now include: (1) inadequate technical assistance in keeping the technology up and running and facilitating the use of the technology; (2) time and training to understanding how the technology fits with the overall mission of teaching students. Right now, based on these discussions, the majority of these educators see technology as running parallel to the learning process, rather than being integrated into it.

Dimension 1: Learners

Rather than being integrated into the learning environment, technology use with students, by and large, runs parallel to the academic-content areas.

Useful integration of technology into the learning environment is the ultimate goal of the state's investment in education technology. Gaining student fluency with technology includes not only strengthening basic skills, but developing higher-level skills that allow students to think, understand, communicate and learn in new and more productive ways.

While the presence of technology (in terms of "boxes and wires") in the classrooms and schools was evident from our discussions with teachers and administrators, its presence in the context of learning was less apparent. The discussion of how students are using technology across focus groups was limited in depth and scope, because so much of the discussion focused on the issues of acquiring the technology and improving professional competencies in ways to use the technology in the learning environment.

Discussion of student use of technology focused mostly on training them in the basic skills, such as keyboarding and using word processing. Consensus was that students can benefit from the proper use of technology, especially in terms of problem-solving, organization and research skills, and responsibility for their own learning. Most participants, however, did not believe they were there yet. As a teacher in the Region 3 Focus Group stated,

> *I don't think we're integrating technology into instruction. We're using it more as remediation or independent learning.*

There was some discussion of more-advanced learning with technology. For example, in one northern region, participants spoke of: (1) teachers using PowerPoint for lesson presentations, then making those presentations available for review and for absent students to use in catching-up; and (2) students engaging in projects that sent them to the Internet for research, to spreadsheets for data analysis, and to word-processing programs for writing reports. Things that had been tried by participants with success included the following (from a facilitator in the Region 3 Focus Group):

A high school teacher described a lesson on different religions and asked the question, "What was it like in 1940 compared to today?" She had the students use the Internet for research. Students imported data to word processing and spreadsheets. Using these data, they created graphs and pie charts.

Because some of the teachers in the focus groups lacked knowledge and experience of using and integrating technology into the learning environment, they continued to view it as separate from the curriculum—an add-on that should not be "taught" at the expense of the basics—rather than as an integral part of the curriculum. Said a teacher in the Region 7 Focus Group, "The computer is not going to teach [verbal and social skills]. I don't want to get caught up in technology at the expense of the basics."

Participant recommendations to the state regarding *Learners*:

- Provide every teacher and administrator with the necessary tools to responsibly use various technology applications to prepare and evaluate students;

- Provide a model for the state's expectations of technology in the elementary-, middle-, and high-school classrooms;

- Be realistic and fair in your expectations about what educators can and cannot provide, given existing resources, local contexts and timelines.

Dimension 2: Learning Environments

While technology may be available in the schools and classrooms, a lack of understanding about how to manage and use technology keeps it from being integrated into daily instruction and learning. Furthermore, while the (SOLs) are a core part of the learning context, educators are struggling with how to effectively use technology in reaching them.

Much of the focus-group discussions centered on having a lack of manpower to create an "ideal" technological-learning environment. Often cited as barriers to better integration were a lack of training for teachers about how to use technology and how to integrate it into the curriculum (particularly when there may be only one or two computers in a classroom), and a lack of technology expertise in each school to maintain the technology.

Teachers reported difficulty in designing activities that allow them to work directly with the students on computers, while keeping those who weren't actively engaged in computer-related activities focused on and engaged in other learning activities. The management problem seemed especially acute at the elementary levels, where the students have neither the skills nor maturity to do schoolwork on computers without supervision. A Region-7 teacher put it this way:

> *Management is the biggest issue. How do you experiment with technology activities you have never done before and keep the classroom running smoothly?*

Discussions of how to create learning environments in which technology is integrated focused heavily on integrating technology across the Standards of Learning (SOLs). Because educators focus heavily on the SOLs, unless technology is specifically mentioned within a Standard, at this point technology will not be used. Participants felt they needed more direction from the state in how to use technology to achieve the SOLs. Specifically, they thought the Virginia Department of Education should provide schools with resources, materials, and training on how to use instructional technology and how to integrate it into the curriculum:

> *Saying that the SOLs are a "shared responsibility" is a rather nebulous term...there needs to be some coordination. If you don't have the equipment, it is just another situation where the state has mandated without providing the financial resources to fulfill the mandate.*
>
> *—A Region-4 principal*

> *The SOLs provide the objectives to be reached by students at each level. What is missing is the direction on how to attain it with technology. For example, one SOL specifies that students will create projects with technology. Does the state assume we have LCD projectors and digital cameras to do this? We don't. How do they envision the SOLs to be accomplished?*
>
> *—A Region-4 teacher*

Several participants observed that the state emphasizes integrating technology throughout the curriculum, but has established separate SOLs for technology and is testing them separately. Participants asked for a more-consistent approach that would imbed the technology skills into the core subjects at appropriate points and also include assessments of the imbedded technology standards as part of the core-subject tests:

> *It certainly would be a benefit to remove the technology SOLs. Technology should not be measured as a separate entity but should be examined in its integration into curriculum and administration. It seems counter-productive to set it apart as a separate tool.*
>
> *—A Region-5 parent*

Participant recommendations to the state regarding *Learning Environments:*

- Give us the time we need to meet and "work these things (how to use technology in meeting the SOLs) out"
- Provide resources to achieve the SOLs that would reach more people including state-developed curriculum and lesson plans that educators could use in their classrooms.
- Always have, at the forefront and basis of any plan, that technology is not a luxury skill but a life skill. Each student leaving us—from McDonald's worker to mechanic, from doctor to secretary—will need proficient technology skills.

Dimension 3: Professional Competency

While many of the teachers we talked to seemed "ready to go" in terms of using technology, and many were using technology, they were also frustrated by the lack of appropriate and relevant technology training, authentic models for how to integrate technology, and technical assistance with using and trouble-shooting the technology.

The consensus was that teachers were becoming more comfortable with technology for their own productivity/management purposes, but did not necessarily understand how to integrate it into the curriculum at a high level:

> *I think teachers are coming on board more and more. It's just a matter of time. I would prefer that the training take place during the certification of teachers, rather than developing checklists, etc. I think younger teachers are coming in with computer skills and most of them are computer literate.*
>
> *—A Region-4 teacher*

> *I think we are holding back kids if we don't do some of these higher-level projects... Teachers will tell kids to make a diorama or a poster; well why not a PowerPoint slide show? I think it is the comfort level of the teachers that hold kids back.*
>
> *—A Region-4 teacher*

> *Kids seem better able to handle technology than the teachers, and that makes teachers uncomfortable. If a teacher is afraid of the technology, to handle it, then she'll be afraid that kids will be running amok.*
>
> *—A VETAC member*

Many focus-group participants thought the state's plan for providing technology and related equipment to schools was on the right track, but that the training of teachers in using the technology was severely under-funded. A Region-1 Group Facilitator noted that an instructional specialist indicated that the district receives approximately $100,000 each year for technology from the state but that only $5,000 of that could be used for training teachers. Said the division's instructional specialist: "You can't train 2,000 teachers with $5,000" She went on to estimate that about one-half of the equipment in schools went untouched because teachers didn't know how to use it.

Participants in several focus groups felt that the state should put money into teacher training, almost before it funded more equipment. While teachers reported participating in several different types of professional development, including conferences, classes at community colleges, classes provided by the division and by the state, and training by vendors, consensus was that technology training was best done locally, on an as-needed basis:

If the state would provide the funds for in-service training on technology, then each division could determine its own way to make it successful.

—A Region-5 Media Specialist

I've learned more just sitting down and experimenting [with the computer]. If I have a question, I feel comfortable going to someone I know...someone who has more experience, either in my school or division. Please don't force the training on me.

—A Region-7 Teacher

For those of us who are not comfortable [learning in a workshop format], in-house training works best. This is what we are going to create in our school.

—A Region-7 Teacher

Teachers need the state to bring things into the school for actual use. Teachers are trying to teach, meet the SOLs, integrate technology, do all the other required things—it's too much. One day of training is not enough for me to go back and train 150 students.

—A Region-8 Teacher

Another reason some teachers found workshops and seminars less than helpful: the technology presented in these sessions is not compatible with their school's capacity. One teacher explained that after teachers have been exposed to "state-of-the-art" instructional software and hardware in formal workshops, they often return to their schools to find older models of computers that cannot support the applications to which the teachers have just been exposed.

Not surprising, time and scheduling were cited as key barriers to greater training. Several teachers suggested that the state "keeps giving but doesn't take anything away." Even with adequate training, teachers emphasized integrating technology into the curriculum would still require a significant time-and-planning commitment. ("I need planning time to sit down and see what it is and what I can do with it".) They suggested that "leadership" (e.g., principals, superintendents) needed to understand and buy into the use of technology before that kind of planning time would be made available.

Participant recommendations to the state regarding Professional Competency:

- Provide money to all localities for equal statewide teacher training and staff development, so teachers are more comfortable using computers with students in their classrooms;
- Virginia needs to provide for adequate teacher training. One obvious way to help with this would be to require each school to have an in-house, full-time technology specialist who could instruct teacher and students simultaneously, give teacher groups inservice, and provide individual teacher training on an as-needed basis;
- Provide a laptop computer for each Virginia educator at no cost to the local system, in order for teachers to increase their skill level so they might effectively instruct students.

Dimension 4: System Capacity

Focus-Group Participants lacked a clear vision from the state for technology in schools.

Participants in the focus groups were asked to specify what they believed was the state's vision for technology in education. Across all groups, participants were hard-pressed to articulate a vision as communicated by the state. Some identified the "mission" as the SOLs and the teacher technology proficiency standards. Others disagreed. One principal noted, "While the SOLs represent high minimum standards, they are not the vision for the future."

One teacher suggested that "people on the technology committees know the mission, but people who are out of the loop do not." Others felt the vision was more political rhetoric than reality. This one focus group's degree of cynicism was brought on by their frustration that the schools they represented had profound technology needs that were not being met, and they felt these needs could not be met with local dollars. One teacher pointed out that Fairfax County might be able to meet its technology needs, but her county and surrounding counties do not have the same resources. This Region-3 teacher concluded:

> *If you're going to give a mandate for completion of a standard that teachers as well as students should uphold, it is also necessary for you to have the resources provided in those school systems where it is lacking.*

A Region-4 teacher added:

> *Toward that vision...it would be nice for somebody who had the time and resources to say, "These are things that have worked in other places." And then let schools vary it according to what works for them.*

Many participants felt the state lacked a "systems" approach to equipping schools with technology and helping them use it (many, however, were also unaware of the Six-Year Technology Plan). While most participants felt the state had done an adequate job toward helping schools acquire the technology, some feared that funds would be cut off before schools were fully equipped or teachers had had opportunities to learn about meaningful ways of integrating technology into the learning environment. As a Region-7 teacher stated,

> *We are aware of a vision, but in our day-to-day lives we're not really clear on what that vision is. Computers are coming in, but we are not really sure what we should be doing with all of this technology.*

A member of VETAC added:

> *There needs to be alignment. We want to put a lot of money toward technology but we can't do it without support and training. We can't break one element out from the rest or we will fail. All systems need to align together and have to support each other.*

Finally, in discussing the vision for technology statewide, all focus groups—from the resource-wealthy divisions to the resource-poor divisions—talked about the need for the state to ensure equity in the distribution of funds and resources for technology. For example, one teacher urged that in funding technology, the state make it clear to the divisions that these are *supplemental* funds, and should not supplant local funds. Another teacher suggested that the state needs to ensure a *basic-technology infrastructure* for every school then leave it up to the divisions if they want to move beyond that. A principal suggested that while schools need to learn to use what they have available to them now, it would be helpful if the state provided guidelines or a basic framework of what each school minimally should have in terms of technology.

Participant recommendations to the state regarding *System Capacity:*

- Change the funding formula in order to address inequalities of distribution and access, including elimination of the L-estimator as the method of calculating SOQ costs and the addition of capital outlay to the distribution equation;

- Provide adequate funding to support technology and updating on a constant basis. Just providing funds for one year doesn't satisfy keeping current with the technology. The State should if at all possible begin leasing computers so that updates can be on a constant basis;

- Virginia keeps adding more requirements for schools but doesn't realize that it is not adding enough personnel to implement these requirements. The state cannot keep piling on expectations and requirements without addressing this. We have $3 million worth of computers sitting in boxes because we don't have the personnel to unload and unpack them, much less set them up;

- Look before you leap. Think it through in a systemic way. Follow through. Don't pull the plug!

Dimension 5: Community Connections

The focus-group discussions about community connections and school-community partnerships were limited and thus cannot be adequately addressed here. One issue that *was* discussed was the need for effective computer-networking capabilities that would allow communities to have access to their schools as a resource, allow for professional communication among educators as other industries already have, and most importantly, eliminate the "information deficit" for students living in remote or resource-poor areas.

Dimension 6: Technology Capacity

Technology exists in the schools, but the essentials to its use—training and technical assistance—are not there yet.

As reported earlier, focus-group participants were generally satisfied with the level and quality of technology available to them and their students. They did, however, readily describe the "ideal-technology" classroom when asked, such as the following "wish list" from a Region-3 Focus Group:

The "ideal" classroom would have pods of computers (five to10), projection and peripheral equipment such as scanners and printers, Internet access, and related software. The school would have both dedicated labs (e.g., for business education) and general labs (to which academic classes would have ready access). Depending on its size and needs, the school would have from one to three full-time support personnel provided by the state: one instructional technology specialist to assist teachers in integrating technology; one network engineer to keep LAN and WAN networks functioning, and to make sure every classroom had working access to the Internet; and one technical person to troubleshoot and maintain equipment. Each teacher would have a laptop provided by the state, and would have to show proficiency and use. Other technologies such as TVs and VCRs would be readily available in every classroom.

The larger problem beyond available technology, as participants saw it, was the lack of support teachers receive on a day-to-day basis. For example, while many schools represented in the focus groups had computer labs, few had staff available to assist teachers and students on a daily basis. Consequently, the labs were under-used by the teachers who had limited computer skills.

The general consensus was that there is not adequate technical support to provide timely, expert trouble-shooting, technical assistance, ongoing maintenance, operations and upgrades. In the words of a Region-1 library-based media specialist:

Two to three weeks is too long to wait [for technical assistance]!

Very few of the focus-group participants indicated that a full-time technology-support person was available in their schools. Some had technology representatives—meaning teachers who teach full time and receive a small stipend for providing whatever technical assistance they can when they can. But this is not enough. As such a representative from Region 4 stated:

> *It's a time problem. No amount of money will provide you with the time you need to do it. Plus, I'm not always available—often I'm in my own classroom when other teachers need me. We need a full-time computer educator, not just a hardware repairman.*

Consensus was that the support had to be both technical and instructional in nature but participants also recognized the challenge in filling this type of position. One person noted that his school system could pay such a person only $25,000 a year, while many of these types of technicians demand much more.

Participant recommendations to the state regarding Technology Capacity:

- Remember that not all school districts are the same size, nor have the same resources available, nor are in need of the same technology. I think all schools are trying to meet the technology standards addressed by the Commonwealth with a limited amount of dollars.

- Provide ongoing long-term funding for schools for training, maintaining, and upgrading technology. The funding should be in the form of price reductions for the newest technology available. The price reductions should be available for instructional personnel as well. The funding for training could be available in the form of simple and clear grants that can be renewed.

- When providing support, please consider all aspects of its intended purpose. Purchasing hardware and software needs to be supported by a human infrastructure, to provide technical assistance, repair, and training.

Dimension 7: Accountability

Teachers do not oppose accountability around the use of technology, but they want time to "figure it all out" before being made accountable for outcomes.

As in the discussion of Learning Environments, the discussions on Accountability focused heavily on the technology SOLs and the capacity of schools to reach them. The SOLs were mentioned by many of the teachers as one of the first things they think of in connection with technology. This connection, however, was often a threatening one. Many teachers felt they were being held accountable for the technology SOLs when they often: (a) did not have the resources to teach them; and (b) did not know the content of the state tests. While most participants were supportive of the technology SOLs, there was concern about the lack of integration with the other academic areas and the fact the students are tested at only the 5th and 8th grade levels. Many of the participants felt that too much of the responsibility for teaching the skills and knowledge required by the state tends to fall on the shoulders of the 5th and 8th grade teachers. Simply put, participants felt that all of the content could not be covered in these grades alone. Teachers expressed a need for a clear and systematic plan that specifies the scope and sequence of what is to be taught at each grade level (it should be noted that these criticisms and suggested solutions were not limited to the technology standards, but rather applied to all content areas covered by the SOLs).

A second criticism of the technology SOLs: the test used to measure students' technological competencies emphasized technical vocabulary at the expense of relevant technical skills. Some participants questioned the appropriateness of using pen-and-pencil tests for assessing the technology SOLs and wondered why the technology standards end at the middle-grade level. As a Region-8 teacher explained:

> *A student can go through high school and not take a computer course and still graduate. There needs to be a system. Computer classes are not mandated, so teaching technology falls on the core-course teachers. If the teacher is interested in technology then she will get the training to use it in the classroom; if she is not interested, kids won't be exposed to it. We need the state to help facilitate this, and not have a fragmented approach.*

As previously mentioned, the overall consensus was that before educators can even begin to talk about accountability and impact, they needed time to learn how to integrate technology, to understand how and when to use technology, to become technology literate, and to explore and develop a learning environment that integrates technology in meaningful ways.

Participant recommendations to the state regarding *Accountability*:

- Make sure educators have the tools and training before requesting a product.

- Help us monitor our progress. Provide a regional technology unit to help with technical assistance and monitoring progress.

- Remember, we need to do what's best for children, not what's best politically.

In summary, participants across these focus groups seemed genuinely appreciative of the state's assistance in beginning to build an educational infrastructure. They acknowledged the increase in technology in the schools over the past few years, and applauded the state for its efforts to date. But a lack of vision (or not yet communicated to them) and lack of a system for putting it all into action also frustrated them. They seemed eager to learn to use the technology they have acquired; training and technical assistance issues dominated much of the discussions. Finally, while they support the SOLs in general, they questioned some of the relevance of the technology SOLs and their lack of integration across the other content areas. They did not oppose accountability around technology, but they felt a need to understand it within the overall system.

Table 1 School Divisions Participating in Focus Groups

REGION	SCHOOL DIVISION
1	Richmond City, Sussex County, Surry County, Isle of Wight County
2	Norfolk City, VA Beach City, Portsmouth City, Hampton City
3	Spotsylvania County, Stafford County, King George County
4	Warren County, Fauquier County
5	Fluvanna County, Albemarle County, Charlottesville City
6	Pittsylvania County, Danville County
7	Galax City, Carroll County
8	Greensville City

A Cross-case Analysis of Findings from Site Visits in 48 Virginia Schools

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Introduction

During September 1998, 16 school divisions were selected in Virginia, representing a wide variety of urban, rural, and suburban locations throughout the Commonwealth. (See the Appendix to this paper for a list of the divisions and schools.) Beginning in late September, site visits were conducted in three schools in each division—one elementary school, one middle school, and one high school—for a total of 48 schools. This document presents the major findings from the site visits, organized by the seven dimensions used as a framework for the VDOE-sponsored study. A final section summarizes five key findings from the site visits, across the seven dimensions.

Keep in mind that site visits cannot be relied upon, *by themselves*, to provide statistically valid generalizations about the universe of schools in Virginia. Findings from the site visits need to be supplemented with data from the surveys of principals and teachers, as well as with information gathered in the focus groups.

I. Learners

The learner dimension: Are learners using the technology in ways that deepen their understanding of the content in the academics standards and, at the same time, advance their knowledge of the world around them?

- **Growing sophistication.** Students' uses of technology have become increasingly sophisticated over the past three to four years, according to many teachers. The students no longer use computers solely for word processing or drill-and-practice. More students are now encouraged to develop attractive presentations, undertake multimedia projects, and conduct research using technology.

- **Impacts on academic success: too early to reach conclusions.** Although there are anecdotal accounts of students using technology to perform academic tasks more accurately and more efficiently, the data on student performance gathered from site visits is inconclusive. This is likely because the integration of technology into classroom curriculum is only in early stages at many Virginia schools. Some accounts emerging from site visits indicate that student writing, research, and presentation skills have improved as a result of utilizing computer technology. Also, the reinforcement of skills by computer drill-and-practice is perceived by many teachers to have positive impacts on students' test scores.

- **Increased student motivation and enthusiasm to use technology.** Typically, the use of technology in classrooms is eliciting positive reactions from students. Students are exhibiting high levels of interest in content material mediated through technology, and are engaging in technology-related classroom tasks with enthusiasm. Teachers report that the novelty of technology use in the classroom captures students' interest and can translate into increased motivation to learn.

Technology Can Help Motivate Students to Read

It is the perception of many teachers and principals that students seem more motivated to learn when they are actively engaged in tasks that require the use of technology. For example, at many elementary schools in the state, the *Accelerated Reader* software package is used to encourage students to read books. This software program has been facilitated by a group of publishers of children's trade books and its use does not require that many computers be available. Students select books to read from a long list of a variety of books, at different reading levels. Upon completion of a book, the student accesses a test, via the computer, to assess the student's comprehension of that specific book. In some schools, the student's score on the test determines a number of points earned, either individually or for a student team, and points may be used to claim a prize. This program has stimulated students to read trade books for meaning and often stimulates support from the school's Parent-Teacher Association as well as from teachers and principals.

- **Correlates to learning with technology.** In the majority of site-visit schools, the impact of technology on students' academics is perceived to be directly related to: ready access to technology in classrooms; teachers' comfort with using technology; and adequate support within buildings and by school divisions.

- **Special education.** A number of teachers report that the use of technology in special-education classes has positively affected students' comprehension as well as students' engagement in academic tasks.

II. Learning Environments

The learning-environment dimension: Is the learning environment designed to achieve high academic performance by students through the alignment of standards, research-proven learning practices and contemporary technology?

- **Uses of technology.** The most frequent uses of technology in Virginia schools seem to be for: remediation; drill-and-practice; writing (using word processors); and in vocational, business, technology, and special education classes. Library research is another major area of use. Activities that include Internet research, scientific simulations, group learning/problem-solving activities, e-mail communications, and Web-page construction appear to be utilized to a lesser extent, and least of all in high schools.

- **Drill-and-practice.** Software programs that diagnose a student's strengths and weaknesses in a subject, and provide focused drill on the areas assessed as needing work, seem to be frequently used in elementary and middle schools and somewhat less often in high schools.

- **Other forms of integration.** Integration of technology to teach concepts or support group projects in other ways (apart from skills and drills) seems to be most frequent in middle schools, somewhat less frequent in elementary schools, and rare in high schools (with the possible exception of graphing calculator use in *some* math classes). Teachers whose pedagogical approach already favors student-centered group work appear to more readily integrate technology into the curriculum in meaningful ways, compared to teachers who don't typically have students doing group work.

Technology Makes Possible New Types of Projects

At one middle school, teachers design interdisciplinary, thematic units that use technology. In math class, for example, students collect scientific data about streams and rivers and enter it into databases as they work in the field. After returning to the classroom, students analyze the data, develop graphs, make comparisons, conduct further research via the Internet, write reports, and make presentations. A teacher who is comfortable using technology and a student-centered collaborative approach to teaching and learning is more likely to integrate technology effectively into the curriculum for student projects.

- **The importance of location.** The physical placement of computers within schools and classrooms is a major determinant of the ease with which collaborative group projects can be facilitated. For example, in one elementary school that has multiple computers in each classroom, the computers are located so close to each other that teachers found it difficult for small groups of students to work collaboratively in front of the computers. Similarly, if teachers use laboratories, it is important that they be easily accessible and also available for use on a regular basis.

- **Graphing calculators are dominant in high school mathematics.** The primary technology used by teachers of mathematics, particularly in high schools but also in some middle schools, is the graphing calculator. Few if any computers are used in mathematics instruction—apart from drill-and-practice software, which is used in some schools.

- **Uses of multimedia CD-ROM software.** CD-ROMs seem to be used most commonly in science and social studies classes and for research in libraries.

- **Key barriers to greater use of computers.** Barriers frequently mentioned in the site visits include:

  - inadequate quantity and/or quality of equipment and software;
  - lack of adequate and timely technical assistance;
  - inadequate time for teachers to identify, learn and practice using the appropriate applications;

- difficulty of accessing or using computers within schools;
- network failures (often chronic);
- inadequate access to the Internet;
- too little professional development focusing on integrating technology into the curriculum.

III. Professional Competency

The professional-competency dimension: Is the educator fluent with technology and does he/she effectively use technology to the learning advantage of his/her students?

- **Teachers are learning to use a variety of computer applications.** Teachers appear to be making real progress toward meeting the state standards in technology for instructional personnel. Many teachers are acquiring basic skills for operating computers and for using different types of software. Although large numbers are still acquiring basic knowledge and skills for computer use, a growing number are developing their competence in adapting classroom technology so that it becomes an integral component of student learning and curricular change.

- **Teachers increasingly use computers for administrative and management tasks.** Teachers most frequently use computers to perform administrative tasks and to help manage their own work. In many of the schools visited, adults use computers for maintaining grade books, monitoring attendance, generating grade reports, and recording student lunch selections. Additionally, as teachers are exposed to new software applications, they are taking advantage of computers to create classroom materials, write reports, make slide presentations, and conduct their own research on the Internet.

- **Barriers to increased technological competency.** In every school division, teachers are making a major effort to increase their knowledge and skills in the use of technology. Nevertheless, teachers cited a number of barriers that currently limit their ability to achieve increased proficiency in technology. Although some divisions help subsidize technology-training costs, many teachers indicated they must use their own resources and their own time to increase their professional competency. The lack of time and funds were cited as the major barriers teachers face.

Time is Needed to Integrate Technology into the Curriculum

Although the presence of technology has increased in many schools, the integrated instructional use of technology tends to be occurring only in a relatively small number of classrooms. One of the more critical barriers hindering this integration is the lack of time. In one school, the media center specialist indicated, *"We're far along in terms of [computer and technology hardware] capabilities, but we will continue to float along if we don't find a way to integrate it better. Teachers don't have the time to get together..."* Teachers need time to learn about applications, practice new skills, observe other teachers, talk with colleagues, and learn how to manage a new set of resources (including how best to organize classrooms for students to use technology effectively).

Teacher training is happening formally and informally. Training opportunities for teachers in technology comprise a variety of modes and forms. Most divisions and districts provide formal courses or workshops that teachers may attend on their own time. In some divisions, teachers may attend the local community college or university center to take courses. Support for teachers to attend out-of-town training conferences or workshops was also reported in some divisions. Teachers in some divisions indicated that the use of peer coaching and instruction is an effective means of training teachers.

Good Practices in Teacher Professional Development: Teachers Training Teachers

One effective model of teacher professional development using technology involved on-site peer instruction. In one school, an outside expert came to train some of the teachers, who then went on to train the other teachers. Although not mandatory, these training sessions were usually filled to the capacity of standing room only. Teachers have become so technologically adept that they now have a list of "experts" within the school who can assist with certain software programs. The faculty continues to hold impromptu training sessions, and they have demonstrations at faculty meetings for new teachers in order to acquaint them with instructional uses of technology in the school.

IV. System Capacity

The system-capacity dimension: Is the education system re-engineering itself to systematically meet the needs of learners in this knowledge-based, global society?

- **Varied visions of technology use abound within the system.** Although there is some alignment occurring within Virginia schools and divisions to realize the state's goal of increased use of technology for instruction, there appears to be a lack of clarity among staff, teachers, and administrators about the vision and how to put it into action. Across the different sites, using technology for educational purposes means different things to different people. Sometimes, technology is viewed as a set of requirements for students to meet (e.g., learning to use PowerPoint). Sometimes, technology is viewed largely as a way to track students' progress on Standards of Learning (SOLs) and provide drill-and-practice as needed. And sometimes teachers see technology as a way of changing curriculum and instruction in more fundamental ways, e.g., by allowing students to become more independent learners.

- **School and division leadership is of primary importance.** In many schools, strong school and division leadership was cited as critical to the effective implementation and use of technology. Having "champions" at the division level (e.g., superintendents, technology coordinators, technical support staff) and school level (e.g., on-site technology directors, teachers, media specialists, principals) is seen as vital to the successful use of technology for instruction. Such leadership is found in many places, but is absent in others.

- **There is a need for greater technical and instructional support.** The growth of technology in Virginia schools appears to be exceeding the system's capacity to provide adequate technical and instructional support to those who are using the technology. Not only is there a need for more technicians who can maintain the hardware and networks, there is an equally critical need to have instructional-support staff in the schools to assist teachers in using technology for appropriate and significant learning activities for students.

- **There is a need for increased financial resources.** Although ample evidence shows that state funding has helped equip Virginia schools with the best technology available, many teachers and administrators believe more funding is needed to keep up with the pace of technological change and build an infrastructure that will support educational technology in the future. Many schools make good use of older computers, but cannot upgrade them, or the corresponding software, due to lack of funds. Additionally, teachers and principals note the need for more funding to increase teachers' professional competency.

- **Energizing partnerships can increase the system's capacity.** There are some notable examples of innovative school-community relationships that have catalyzed change within schools and divisions and increased the capacity of the educational system to utilize technology. Key school partners include the Parent-Teachers Associations, local businesses, local municipalities, and religious institutions.

The Importance of Strong Leadership

A number of people cited strong, visionary leadership as a key factor for realizing productive visions for the use of educational technology. In one school, teachers spoke of the foresight of the principal and his leadership in transitioning the school to being the technology magnet. One teacher stated, "*He empowered the teachers and got their input…he formed the technology committee and first started the training…*"

V. Community Connections

The community-connections dimension: Is the school-community relationship one of trust and respect, and is this translating into mutually beneficial, sustainable partnerships in the area of learning technology?

- **Connections between Virginia schools and the local community are beginning to form.** The majority of the school sites visited had minimal links with the local community with respect to educational technology, reflecting the early stages of change in school-community relationships. During this period of rapid technological transition, school leaders are beginning to see the value of school-community partnerships in funding, implementing, and utilizing learning technology, but only a few have established any lasting partnerships in this area. Support from and ties with the local Parent-Teacher Association appear to be the most-common community relationships, while links with local businesses, city governments, universities, and other institutions are less common.

- **Leveraging and sharing community resources.** In a few divisions, special bond issues or tax levies have been approved by the local community that have provided a dramatic infusion of funds into the school division to support the purchase of technology. In one case, the initiative came from the business community in the form of increased support for technological training in the schools. In another case, a state economic-development grant was used to provide free summer courses for local retirees and schoolteachers. At yet another school, teachers and students were able to use the computer-lab facilities at the local university. Many schools are in the process of identifying fruitful partnerships that could yield increased benefits to both the school and the local community.

VI. Technology Capacity

The technology-capacity dimension: Are there adequate technology, networks, electronic resources and support to meet the education system's learning goals?

- **Hardware and software capacity is growing rapidly.** Changes in technology capacity are occurring in many schools at a dizzying pace. For example:

    - At one middle school, five years ago there were six computers in the whole school; now there are 155, and they are used daily in instruction. In social studies, for example, students create Web pages and use HyperStudio to create projects.
    - Five years ago, there were only 75 computers not dedicated to use by business classes at one high school; now that figure has risen to 350. Some classrooms are equipped with five computers, there are also several computer labs, and *all* of the computers have Internet access.

- **Internet access is growing rapidly, but is still problematic in many schools.** Many of the schools that we visited will be increasing Internet access in the near future. A number of schools already have exemplary access, such as one rural elementary school serving a high-poverty population that has Internet access in nearly every classroom. Other schools have almost no access, practically speaking—such as a suburban high school of more than 1,800 students, in which only three of the computers available to students can actually access the Internet.

- **The number of computers located in classrooms is limited.** Many schools have no more than one computer installed in each classroom. Teachers indicate that this limits what they can do to integrate computers into instruction.

- **Computer laboratories serve varied, often specific, functions.** Many schools have computer labs, used for a wide array of purposes such as: Plato system software; Computer Curriculum Corporation software; technology courses (e.g., Cisco networking); mathematics; business; keyboarding; and computer programming. Sometimes, a whole lab may be dedicated to students' writing. The availability of labs for general purposes (besides the primary purposes, as noted) is often limited.

- **The library or media center is a key venue for computers.** School libraries use computers for a number of purposes: to replace the card catalog, for CD-ROM reference materials, and to access the Internet, among others. Some school libraries have dozens of computers—but others have only a few. If a school has any Internet access at all, it is usually found in the library. As a corollary, school librarians often provide some of the technical advice to teachers, and may even teach some of the important computer skills (such as doing research on the Internet). However, the librarians are seldom relieved of any other duties, so they have little free time to support teachers' and students' uses of technology.

- **Ubiquitous computer** technology is rare. A few schools have reached a point where computers are ubiquitous in typical classes. One is a middle school that purchased 460 Emate computers and will be allowing all fifth graders to take a computer home; next year, the policy will extend to sixth graders as well. In this school, a majority of students use computers as tools in multiple subject areas (e.g., science, English). In a larger number of schools, computer use is common in courses based in or around computer laboratories (such as computer programming). As the cost of computers and computer-like devices continues to fall, such examples of ubiquitous technology are likely to become more common. Yet, at present, for students in typical Virginia classrooms the computer is not ubiquitous. (As far as other technologies: in secondary mathematics, within some schools and some classes, the graphing calculator is so easily available, and so well accepted, that it is almost second nature for teachers and students to use it. And in certain schools, video has also become ubiquitous, with all classrooms having TVs and also, in some cases, video-capable cabling to a media center.)

Putting Technology in Place is Only a Start

In recent years, schools in Virginia have put in place a remarkable number of computers and networks. Some wonderful things are being done with the technology. Yet putting computers into schools is no guarantee the teachers will understand how to use them well, will receive the support that they need, or that the computers will be available in the right places at the right times. At one wealthy, suburban, middle school, the leadership professes to be committed to technology, and a visit showed that the existing technology (including many dozens of computers) is up-to-date and impressive. But there are virtually no computers available for instruction in classrooms; they are clustered in several labs, and teachers must schedule time to bring in their students. Technology seems mainly to supplement the existing curriculum rather than to present new opportunities (e.g., for interdisciplinary work; group work; access to outside experts; or links to current, real-world issues). Computer use is dependent on the ability, know-how and attitudes of individual teachers. Too many teachers at the school suggest that by using high-tech tools themselves (e.g., PowerPoint) they are truly "integrating" technology into the students' curriculum. Still, the teachers believe the students' use of word processors has increased their competence in writing and that many students are learning important computer-related skills such as conducting research using the Internet.

- **A wide variety of other technologies besides computers were found.** Among the sites visited were schools containing video studios (sometimes the source of regular student "newscasts" within the building), satellite receivers, distance learning opportunities, Channel One, telephones in each classroom, large screen TV-monitor combinations, LCD panel displays, computer projectors, graphing calculators, laserdisc players, VCRs and robotics labs.

VII. Accountability

The accountability dimension: Is there agreement on what success with technology looks like? Are there measures in place to track progress and report results?

- **Technology standards for instructional personnel are widely accepted.** Principals and teachers seem to believe that these standards are "here to stay" and make sense. Many teachers are participating in professional development to learn more about technology, sometimes with the support of their school division. For example, one division is focusing this year on helping teachers meet Standards 1, 2, and 8.

- **There are a variety of opinions about the technology standards for students.** Many principals and teachers accept the standards as reasonable, although some believe the standards may be set too high. The biggest concern, evident at a number of sites, appears to be that schools will be held accountable for student competencies that the schools are not in a good position to teach. In one poor, agricultural county, for example, there has not yet been much, if any, emphasis on teaching students to use spreadsheets or to design Web pages. The schools currently lack hardware and software that would enable them to teach these skills.

- **Opinion is mixed about the impact of all Virginia SOLs on the use of technology.** There is little question that, in many schools, instruction is very much affected by the entire set of Standards of Learning (SOLs). The SOLs "loom large," as one person said. Some teachers believe that drill-and-practice technology will be especially useful in helping their students meet the SOLs. Other educators view the role of technology very differently, such as one middle-school principal who said, "we need to move away from that [drill-and-practice]... I'm trying to encourage more interdisciplinary work." Other people believe that teachers are so focused on the importance of having students meet the SOLs that they will not take time to use technology except in ways that are absolutely necessary (such as to meet specific technology SOLs).

Summary: Five Major Findings Across the Seven Dimensions

- **The state's investments are evident.** A majority of the schools we visited contain at least one computer in each classroom and some have as many as five. Many schools have computer labs. Access to the Internet is growing rapidly.

- **A time of rapid transition.** In most of the site-visit schools, work is under way to install better technology (e.g., more computers; new or improved networks) and services (e.g., e-mail for teachers). Similarly, many teachers are currently engaged in professional development to learn more about computers and their applications. Change is very rapid in many schools and divisions.

- **Enormous variation across schools and classrooms.** The nature and the quality of the uses of technology in instruction vary greatly from school to school. Even within schools, there is often a wide variation by teacher. Some schools and some teachers succeed more than others at integrating technology into instruction in ways likely to make a real difference to students. Not having enough money for technology and support services is a barrier in some places—but the visits show that money alone is not sufficient. We found other important factors to include: people's visions of the uses of technology; school and district leadership; and the nature and extent of teachers' knowledge and skills.

- **Educators want more support for using technology effectively to meet Virginia's Standards of Learning (SOLs).** Many teachers are learning for the first time how to use a computer, including such basic applications as word processing. Given this context, it is understandable why educators struggle to understand how computers can be used effectively to support instruction and meet the SOLs—both the technology-specific SOLs and all others. Many teachers and administrators identified the availability of more *instructional* and *technical* support in schools as an important need.

- **Some divisions are constrained by limited resources.** Various school divisions demonstrate a large disparity in per-pupil funding for technology. In some divisions, the state's investment has been extremely important because few other resources have been invested in technology; in others, the division's own contributions have been far larger than the state's. As a result, the technology infrastructure and support systems vary greatly across divisions. In several school divisions, spending on technology is at the level of $1,000 per student over a three-to-five-year period, which far exceeds the amount allocated by the state. At the other extreme, some school divisions appear to allocate less than $100 per student for a comparable period.

Access to Technology in Schools with Limited Resources

> *Getting a priority on technology at the county level is difficult. This is a small, poor school division. There is not a lot of pressure from the PTA or the parents to do more with computers here. I need to look hard at budgets even for color cartridges and for paper. It mounts up. I have a 1st grade teacher who does a wonderful job. But is she entitled to use all the color? I know we could use a computer lab, but we are using closets for some teachers as it is; there is no place for one.*
>
> *—A principal of an elementary school in a low-income area*

[In this school division], we struggle just to rub two nickels together.
—A district director of vocational education

We lost our school-technology specialist last year, and it wasn't until March that another person was hired.
—A librarian in a poor rural school

Three Especially Interesting Sites

An elementary school: Nine years ago in this rural district, there was only a handful of Radio Shack TRS 80s and a few Commodores in *all* the schools put together. Now, with the assistance of state and district funding, the elementary school brought Internet access to both the school computer lab and to almost every classroom. Students begin using computers for reading instruction in kindergarten. Older students exchange e-mail correspondence with students at a school in Australia. Teachers began using computers to track attendance five years ago; for the past two years they have used computers for grade reporting. The school leadership believes technology should be infused into all aspects of the school environment and the district has a strong commitment to staff development and training; it has increased teacher training in the use of technology, especially over the last three years. Technology coordinators are extraordinary in their ability to acquire old hardware and upgrade it for the schools in the district. For all these reasons, a small rural school in Virginia is rapidly moving into the 21st century. The school obviously benefits from visionary leadership by the superintendent, district office, technology coordinators, lab personnel and the principal.

A middle school: This Blue-Ribbon school is a model of integrating technology into the curriculum, especially in the humanities—despite challenging technical problems and insufficient equipment. The school serves a rural population and 40 percent of its students are non-white. Creative teachers, working in teams, teach from an interdisciplinary, "real-world," project-based perspective. Numerous examples were provided of the use of available technology to assist in the accomplishment of curriculum-based projects: to conduct the research, write reports, manipulate data in spreadsheets and databases, and present findings. Technology seems to be used routinely in creative ways that give students hands-on experience with a variety of software applications.

A high school: The district in which this school is located is highly committed to technology, as evidenced by its technology budget of about $1,000 per student over a three-year period. All the classrooms in the high school have computers with Internet access; also, many additional services (e.g., e-mail for teachers) and new hardware (e.g., six Imac computers for the biology lab) will be available soon. Some teachers are already using technology well, and many are interested in doing more than they do now. Graphing calculators are used in mathematics, and one mathematics teacher is planning to use *Geometer's Sketchpad* software with her students. The biology teacher makes a large inventory of technology resources available to students (e.g., CD-ROMs), and is engaging them in a project involving the National Institutes of Health. Neither the English nor the history departments seem yet to make much use of the computer, in part because their classrooms have only one computer each. Some exemplary uses of technology (e.g., a Cisco networking lab/class and production of the school newspaper and yearbook using desktop-publishing software) are not in the core academic areas.

Appendix: List of Divisions and Schools Visited, by Region

Region	Division	School Name
1	Hanover	Elmont Elementary School
1	Hanover	Liberty Middle School
1	Hanover	Patrick Henry High School
1	Richmond City	Ginter Park Elementary School
1	Richmond City	Fred D. Thompson Middle School
1	Richmond City	John Marshall High School
2	Northampton	Kiptopeke Elementary School
2	Northampton	Northampton Middle School
2	Northampton	Northampton High School
2	Williamsburg-James City	D.J. Montague Elementary School
2	Williamsburg-James City	James Blair Middle School
2	Williamsburg-James City	Lafayette High School
3	Essex County	Tappahannock Elementary School
3	Essex County	Essex Intermediate School
3	Essex County	Essex High School
3	Fredericksburg City	Hugh Mercer Elementary School
3	Fredericksburg City	Walker-Grant Middle School
3	Fredericksburg City	James Monroe High School
4	Falls Church	Thomas Jefferson Elementary School
4	Falls Church	George Mason Middle School
4	Falls Church	George Mason High School
4	Loudon County	Meadowland Elementary School
4	Loudon County	Farmwell Station Middle School
4	Loudon County	Park View High School
5	Greene County	Nathanael Greene Elementary School
5	Greene County	William Monroe Middle School
5	Greene County	William Monroe High School
5	Harrisonburg City	Stone Spring Elementary School
5	Harrisonburg City	Thomas Harrison Middle School
5	Harrisonburg City	Harrisonburg High School
6	Montgomery County	Harding Avenue Elementary School
6	Montgomery County	Blacksburg Middle School
6	Montgomery County	Blacksburg High School
6	Roanoke City	Monterey Elementary School
6	Roanoke City	James Madison Middle School
6	Roanoke City	Patrick Henry High School
7	Washington County	Rhea Valley Elementary School
7	Washington County	Glade Spring Middle School
7	Washington County	Patrick Henry High School
7	Radford City	Belle Heth Elementary School
7	Radford City	John N. Dalton Intermediate School
7	Radford City	Radford High School
8	Charlotte County	J. Murray Jeffress Elementary School
8	Charlotte County	Central Middle School
8	Charlotte County	Randolph Henry Senior High School
8	Halifax / South Boston	Turbeville Elementary School
8	Halifax / South Boston	Halifax County Middle School
8	Halifax / South Boston	Halifax County High School

Appendix

D

Charts of School Divisions

191

% of Principals selecting options as #1 priority for using added technology funds

Division	# of Schools Responding	Composite Index	Purchasing hardware (computers, video cameras, etc.)	Hiring technology support staff	Training teachers and technology support staff to operate the technology	Upgrading the buildings infrastructure (wiring classrooms, installing networks)	Providing professional development for the effective use of technology
Statewide Average	**1634**	**0.3967**	**24%**	**19%**	**16%**	**12%**	**12%**
ACCOMACK	13	0.3185	38%	15%	15%	0%	23%
ALBEMARLE	18	0.6233	33%	6%	33%	0%	11%
ALEXANDRIA	16	0.8000	25%	0%	13%	0%	13%
ALLEGHANY	8	0.3157	0%	75%	25%	13%	25%
AMELIA	2	0.3334	50%	50%	0%	0%	0%
AMHERST	10	0.3168	10%	60%	0%	10%	10%
APPOMATTOX	3	0.2908	33%	0%	33%	0%	0%
ARLINGTON	26	0.8000	23%	0%	12%	15%	23%
AUGUSTA	18	0.3585	33%	28%	11%	28%	0%
BATH	3	0.8000	33%	0%	0%	0%	33%
BEDFORD	17	0.3942	24%	18%	29%	29%	6%
BLAND	3	0.2652	0%	33%	0%	0%	0%
BOTETOURT	11	0.3963	18%	64%	9%	0%	0%
BRISTOL	6	0.3613	17%	17%	17%	33%	0%
BRUNSWICK	5	0.2685	0%	0%	0%	0%	20%
BUCHANAN	13	0.2668	15%	0%	8%	15%	0%
BUCKINGHAM	6	0.2758	17%	33%	0%	17%	0%
BUENA VISTA	4	0.2501	50%	0%	25%	0%	25%
CAMPBELL	13	0.3010	31%	23%	15%	8%	8%
CAROLINE	4	0.3316	0%	25%	25%	25%	50%
CARROLL	10	0.2963	0%	40%	40%	20%	20%
CHARLES CITY	3	0.3756	33%	0%	0%	33%	0%
CHARLOTTE	6	0.2510	0%	0%	0%	33%	0%

% of Principals selecting options as #1 priority for using added technology funds

Division	# of Schools Responding	Composite Index	Purchasing hardware (computers, video cameras, etc.)	Hiring technology support staff	Training teachers and technology support staff to operate the technology	Upgrading the buildings infrastructure (wiring classrooms, installing networks)	Providing professional development for the effective use of technology
CHARLOTTESVILLE	9	0.5310	22%	22%	11%	22%	11%
CHESAPEAKE CITY	39	0.3560	18%	18%	31%	8%	5%
CHESTERFIELD	48	0.4062	42%	13%	4%	19%	2%
CLARKE	5	0.5241	40%	40%	0%	0%	0%
COLONIAL BEACH	1	0.3029	0%	0%	0%	0%	0%
COLONIAL HEIGHTS	5	0.4871	0%	20%	60%	0%	0%
COVINGTON	3	0.3475	0%	0%	0%	33%	33%
CRAIG	2	0.3215	50%	0%	0%	0%	0%
CULPEPER	7	0.4077	29%	14%	14%	0%	14%
CUMBERLAND	3	0.3342	33%	0%	67%	0%	0%
DANVILLE	14	0.3000	29%	14%	7%	21%	0%
DICKENSON	9	0.2443	56%	22%	0%	22%	11%
DINWIDDIE	6	0.2962	17%	33%	0%	33%	0%
ESSEX	2	0.4544	0%	0%	0%	0%	0%
FAIRFAX	179	0.7199	24%	35%	20%	6%	12%
FALLS CHURCH	2	0.8000	50%	0%	0%	0%	50%
FAUQUIER	14	0.6000	50%	29%	0%	7%	0%
FLOYD	4	0.3391	25%	0%	0%	0%	75%
FLUVANNA	5	0.3968	0%	0%	40%	0%	0%
FRANKLIN	14	0.3899	7%	29%	14%	7%	21%
FRANKLIN CITY	3	0.2883	67%	0%	0%	33%	0%
FREDERICK	15	0.3997	0%	27%	13%	7%	20%
FREDERICKSBURG	3	0.6328	33%	0%	0%	0%	67%
GALAX	3	0.3608	0%	67%	0%	0%	0%

% of Principals selecting options as #1 priority for using added technology funds

Division	# of Schools Responding	Composite Index	Purchasing hardware (computers, video cameras, etc.)	Hiring technology support staff	Training teachers and technology support staff to operate the technology	Upgrading the buildings infrastructure (wiring classrooms, installing networks)	Providing professional development for the effective use of technology
GILES	6	0.3197	67%	0%	0%	0%	0%
GLOUCESTER	9	0.3245	22%	0%	22%	0%	22%
GOOCHLAND	5	0.7975	0%	40%	0%	40%	0%
GRAYSON	11	0.2534	36%	27%	9%	9%	0%
GREENE	6	0.3177	50%	0%	33%	0%	0%
GREENSVILLE	2	0.2436	0%	0%	0%	100%	0%
HALIFAX	16	0.2380	6%	0%	31%	6%	6%
HAMPTON	28	0.2885	32%	14%	4%	32%	4%
HANOVER	18	0.4774	11%	22%	17%	0%	22%
HARRISONBURG	6	0.5477	0%	33%	50%	0%	17%
HENRICO	52	0.5225	12%	37%	17%	6%	8%
HENRY	16	0.3016	19%	19%	13%	13%	13%
HIGHLAND	2	0.5553	0%	0%	50%	0%	0%
HOPEWELL	6	0.2712	67%	33%	0%	0%	0%
ISLE OF WIGHT	8	0.3915	13%	0%	0%	0%	0%
KING GEORGE	2	0.3682	50%	0%	0%	0%	0%
KING QUEEN	1	0.4085	0%	100%	0%	0%	0%
KING WILLIAM	3	0.3811	0%	0%	67%	0%	33%
LANCASTER	3	0.6384	33%	0%	0%	0%	0%
LEE	12	0.1861	33%	58%	8%	0%	0%
LEXINGTON	2	0.4163	0%	50%	0%	0%	0%
LOUDOUN	39	0.6776	3%	5%	8%	0%	82%
LOUISA	4	0.6626	0%	25%	25%	0%	50%

% of Principals selecting options as #1 priority for using added technology funds

Division	# of Schools Responding	Composite Index	Purchasing hardware (computers, video cameras, etc.)	Hiring technology support staff	Training teachers and technology support staff to operate the technology	Upgrading the buildings infrastructure (wiring classrooms, installing networks)	Providing professional development for the effective use of technology
LUNENBURG	4	0.2346	0%	25%	0%	25%	25%
LYNCHBURG	19	0.3915	16%	5%	5%	5%	0%
MADISON	5	0.3919	0%	0%	20%	20%	0%
MANASSAS CITY	6	0.4557	17%	0%	17%	0%	33%
MANASSAS PARK	4	0.3388	0%	25%	0%	25%	0%
MARTINSVILLE	5	0.3294	0%	0%	20%	40%	0%
MATHEWS	3	0.4829	0%	0%	67%	0%	0%
MECKLENBURG	11	0.3329	0%	18%	27%	18%	0%
MIDDLESEX	3	0.5756	67%	0%	0%	0%	0%
MONTGOMERY	18	0.3744	39%	28%	11%	6%	6%
NELSON	5	0.5038	40%	0%	20%	0%	40%
NEW KENT	3	0.4445	33%	0%	0%	33%	0%
NEWPORT NEWS	36	0.2901	39%	3%	19%	28%	8%
NORFOLK	49	0.2905	22%	8%	20%	29%	16%
NORTHAMPTON	5	0.3129	60%	0%	0%	0%	0%
NORTHUMBERLAND	3	0.6365	33%	0%	0%	0%	0%
NORTON	2	0.3484	50%	0%	0%	0%	0%
NOTTOWAY	7	0.2563	57%	0%	14%	0%	0%
ORANGE	6	0.4245	50%	0%	0%	17%	17%
PAGE	8	0.3252	0%	0%	0%	0%	13%
PATRICK	7	0.3013	14%	0%	0%	0%	86%
PETERSBURG	8	0.2319	25%	13%	25%	13%	13%
PITTSYLVANIA	18	0.2868	6%	33%	17%	11%	6%
POQUOSON	4	0.3384	50%	0%	0%	0%	25%

% of Principals selecting options as #1 priority for using added technology funds

Division	# of Schools Responding	Composite Index	Purchasing hardware (computers, video cameras, etc.)	Hiring technology support staff	Training teachers and technology support staff to operate the technology	Upgrading the buildings infrastructure (wiring classrooms, installing networks)	Providing professional development for the effective use of technology
PORTSMOUTH	24	0.2309	29%	13%	17%	17%	4%
POWHATAN	4	0.4131	25%	0%	0%	25%	50%
PRINCE EDWARD	3	0.3146	0%	0%	33%	0%	0%
PRINCE GEORGE	9	0.2736	22%	33%	11%	11%	11%
PRINCE WILLIAM	48	0.4158	10%	25%	19%	17%	8%
PULASKI	10	0.3184	10%	10%	0%	20%	10%
RADFORD	4	0.3412	0%	0%	0%	25%	0%
RAPPAHANNOCK	2	0.7089	50%	0%	0%	0%	50%
RICHMOND	3	0.3467	0%	33%	33%	0%	0%
RICHMOND CITY	41	0.4320	41%	12%	15%	15%	10%
ROANOKE	25	0.4280	28%	8%	24%	8%	4%
ROANOKE CITY	25	0.4157	28%	20%	4%	24%	4%
ROCKBRIDGE	7	0.4067	14%	29%	29%	14%	0%
ROCKINGHAM	17	0.3644	29%	18%	24%	0%	6%
RUSSELL	11	0.2520	36%	9%	0%	27%	0%
SALEM	5	0.4412	20%	20%	20%	20%	20%
SCOTT	14	0.2178	21%	7%	7%	14%	0%
SHENANDOAH	7	0.3966	29%	0%	14%	0%	14%
SMYTH	13	0.2678	38%	0%	15%	0%	0%
SOUTHAMPTON	7	0.3063	14%	29%	14%	29%	0%
SPOTSYLVANIA	23	0.3913	26%	13%	9%	13%	13%
STAFFORD	17	0.3530	12%	24%	29%	18%	12%
STAUNTON	5	0.4075	40%	20%	20%	0%	20%
SUFFOLK	13	0.3276	8%	0%	31%	23%	0%

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% of Principals selecting options as #1 priority for using added technology funds

Division	# of Schools Responding	Composite Index	Purchasing hardware (computers, video cameras, etc.)	Hiring technology support staff	Training teachers and technology support staff to operate the technology	Upgrading the buildings infrastructure (wiring classrooms, installing networks)	Providing professional development for the effective use of technology
SURRY	3	0.8000	0%	33%	67%	0%	0%
SUSSEX	5	0.3369	0%	0%	20%	0%	20%
TAZEWELL	17	0.2691	24%	24%	0%	24%	0%
VIRGINIA BEACH	77	0.3466	22%	8%	17%	17%	6%
WARREN	6	0.4073	17%	17%	0%	0%	0%
WASHINGTON	13	0.3287	15%	38%	8%	8%	15%
WAYNESBORO	3	0.3831	33%	0%	33%	0%	0%
WEST POINT	3	0.3327	0%	0%	67%	0%	0%
WESTMORELAND	2	0.3975	50%	50%	50%	0%	50%
WILLIAMSBURG	11	0.8000	0%	18%	27%	0%	9%
WINCHESTER	8	0.5439	13%	13%	25%	13%	13%
WISE	15	0.2245	33%	33%	20%	20%	7%
WYTHE	9	0.3163	44%	22%	22%	11%	11%
YORK	16	0.3894	38%	19%	25%	6%	6%

Additional #1 priorities selected by less than 10% of Principals statewide:

	9%	Budgeting for hardware and software replacements and upgrades
	7%	Purchasing software and related course materials (CD-ROMs, videos, online services)
	6%	Preparing the building for technology (power, ventilation, security)
	5%	Budgeting for telecommunications services (Internet support provider, phone lines)
	3%	Planning and program development for technology use
	1%	Purchasing supplies (diskettes, paper, toner)

Availability of distance learning technology in schools

Division	# of Schools Responding	Composite Index	% of classrooms Principals say are equipped with:			% of media centers, labs Principals say are equipped with:			We do not use distance learning in our school
			Phones	Computers connected to Internet	TV monitors and cable or antenna	Phones	Computers connected to Internet	TV monitors and cable or antenna	
Statewide Average	**1634**	**0.3967**	**16%**	**56%**	**78%**	**36%**	**60%**	**69%**	**36%**
ACCOMACK	13	0.3185	48%	64%	46%	66%	63%	57%	23%
ALBEMARLE	18	0.6233	76%	99%	77%	79%	94%	72%	50%
ALEXANDRIA	16	0.8000	100%	100%	100%	100%	99%	95%	50%
ALLEGHANY	8	0.3157	2%	98%	75%	43%	97%	78%	25%
AMELIA	2	0.3334	50%	50%	95%	55%	100%	95%	100%
AMHERST	10	0.3168	3%	2%	87%	1%	30%	66%	30%
APPOMATTOX	3	0.2908	0%	100%	100%	26%	100%	97%	33%
ARLINGTON	26	0.8000	13%	56%	83%	42%	58%	71%	23%
AUGUSTA	18	0.3585	1%	35%	68%	21%	34%	46%	22%
BATH	3	0.8000	0%	37%	97%	13%	43%	92%	0%
BEDFORD	17	0.3942	7%	0%	88%	19%	21%	64%	47%
BLAND	3	0.2652	0%	100%	88%	3%	100%	88%	0%
BOTETOURT	11	0.3963	6%	79%	90%	31%	67%	64%	36%
BRISTOL	6	0.3613	28%	25%	100%	62%	50%	100%	33%
BRUNSWICK	5	0.2685	14%	26%	56%	26%	25%	63%	40%
BUCHANAN	13	0.2668	1%	4%	68%	21%	22%	53%	38%
BUCKINGHAM	6	0.2758	0%	51%	67%	42%	69%	57%	50%
BUENA VISTA	4	0.2501	1%	99%	69%	43%	98%	98%	25%
CAMPBELL	13	0.3010	0%	60%	80%	13%	57%	61%	54%
CAROLINE	4	0.3316	0%	50%	38%	0%	33%	4%	75%

Availability of distance learning technology in schools

Division	# of Schools Responding	Composite Index	% of classrooms Principals say are equipped with:			% of media centers, labs Principals say are equipped with:			We do not use distance learning in our school
			Phones	Computers connected to Internet	TV monitors and cable or antenna	Phones	Computers connected to Internet	TV monitors and cable or antenna	
CARROLL	10	0.2963	2%	9%	97%	25%	20%	74%	40%
CHARLES CITY	3	0.3756	98%	0%	28%	98%	9%	40%	67%
CHARLOTTE	6	0.2510	21%	0%	96%	61%	39%	82%	17%
CHARLOTTESVILLE	9	0.5310	5%	65%	50%	52%	72%	58%	56%
CHESAPEAKE CITY	39	0.3560	35%	38%	54%	42%	35%	48%	31%
CHESTERFIELD	48	0.4062	1%	52%	28%	21%	53%	34%	31%
CLARKE	5	0.5241	40%	77%	93%	72%	78%	92%	60%
COLONIAL BEACH	1	0.3029	7%	100%	20%	67%	100%	0%	0%
COLONIAL HEIGHTS	5	0.4871	0%	100%	51%	26%	98%	62%	60%
COVINGTON	3	0.3475	1%	95%	47%	0%	100%	53%	67%
CRAIG	2	0.3215	1%	1%	93%	1%	0%	100%	50%
CULPEPER	7	0.4077	99%	1%	85%	85%	1%	77%	57%
CUMBERLAND	3	0.3342	34%	100%	35%	68%	100%	68%	0%
DANVILLE	14	0.3000	8%	23%	81%	28%	36%	67%	71%
DICKENSON	9	0.2443	1%	3%	77%	20%	7%	74%	11%
DINWIDDIE	6	0.2962	32%	18%	55%	48%	33%	58%	67%
ESSEX	2	0.4544	1%	3%	50%	30%	55%	75%	0%
FAIRFAX	179	0.7199	8%	92%	91%	45%	89%	78%	31%
FALLS CHURCH	2	0.8000	100%	100%	75%	100%	100%	75%	0%
FAUQUIER	14	0.6000	6%	24%	61%	30%	28%	50%	43%
FLOYD	4	0.3391	100%	100%	100%	100%	100%	100%	0%

Availability of distance learning technology in schools

Division	# of Schools Responding	Composite Index	% of classrooms Principals say are equipped with:			% of media centers, labs Principals say are equipped with:			We do not use distance learning in our school
			Phones	Computers connected to Internet	TV monitors and cable or antenna	Phones	Computers connected to Internet	TV monitors and cable or antenna	
FLUVANNA	5	0.3968	0%	40%	100%	23%	90%	100%	0%
FRANKLIN	14	0.3899	9%	87%	68%	20%	66%	51%	43%
FRANKLIN CITY	3	0.2883	34%	40%	68%	35%	70%	68%	33%
FREDERICK	15	0.3997	9%	95%	95%	26%	96%	95%	20%
FREDERICKSBURG	3	0.6328	10%	88%	83%	5%	100%	85%	33%
GALAX	3	0.3608	3%	50%	100%	50%	53%	100%	0%
GILES	6	0.3197	15%	85%	95%	37%	99%	90%	17%
GLOUCESTER	9	0.3245	8%	98%	91%	49%	97%	92%	11%
GOOCHLAND	5	0.7975	0%	80%	74%	20%	80%	66%	40%
GRAYSON	11	0.2534	2%	22%	81%	21%	29%	76%	64%
GREENE	6	0.3177	48%	58%	52%	45%	48%	34%	50%
GREENSVILLE	2	0.2436	1%	1%	88%	1%	4%	49%	0%
HALIFAX	16	0.2380	1%	9%	70%	9%	12%	67%	63%
HAMPTON	28	0.2885	10%	20%	62%	31%	32%	50%	46%
HANOVER	18	0.4774	1%	84%	87%	33%	88%	70%	11%
HARRISONBURG	6	0.5477	33%	61%	93%	43%	76%	73%	33%
HENRICO	52	0.5225	27%	93%	74%	42%	96%	72%	27%
HENRY	16	0.3016	8%	79%	58%	40%	72%	56%	31%
HIGHLAND	2	0.5553	5%	100%	100%	10%	100%	100%	50%
HOPEWELL	6	0.2712	8%	87%	65%	8%	82%	50%	33%
ISLE OF WIGHT	8	0.3915	100%	52%	88%	100%	57%	87%	13%

Availability of distance learning technology in schools

Division	# of Schools Responding	Composite Index	% of classrooms Principals say are equipped with:			% of media centers, labs Principals say are equipped with:			We do not use distance learning in our school
			Phones	Computers connected to Internet	TV monitors and cable or antenna	Phones	Computers connected to Internet	TV monitors and cable or antenna	
KING GEORGE	2	0.3682	2%	1%	90%	3%	3%	48%	0%
KING QUEEN	1	0.4085	2%	100%	100%	2%	100%	100%	0%
KING WILLIAM	3	0.3811	3%	72%	52%	37%	75%	45%	67%
LANCASTER	3	0.6384	0%	43%	52%	42%	33%	82%	33%
LEE	12	0.1861	8%	92%	57%	25%	94%	64%	42%
LEXINGTON	2	0.4163	10%	100%	98%	52%	100%	98%	50%
LOUDOUN	39	0.6776	6%	82%	76%	18%	74%	66%	10%
LOUISA	4	0.6626	3%	98%	80%	13%	100%	58%	25%
LUNENBURG	4	0.2346	0%	92%	75%	33%	87%	68%	25%
LYNCHBURG	19	0.3915	12%	89%	75%	23%	88%	62%	53%
MADISON	5	0.3919	0%	1%	64%	7%	20%	60%	40%
MANASSAS CITY	6	0.4557	0%	100%	100%	5%	100%	100%	0%
MANASSAS PARK	4	0.3388	0%	0%	90%	67%	70%	97%	75%
MARTINSVILLE	5	0.3294	20%	0%	88%	39%	3%	65%	60%
MATHEWS	3	0.4829	33%	59%	90%	50%	55%	90%	100%
MECKLENBURG	11	0.3329	0%	28%	74%	16%	26%	27%	55%
MIDDLESEX	3	0.5756	35%	67%	83%	43%	67%	90%	0%
MONTGOMERY	18	0.3744	12%	88%	75%	54%	78%	60%	44%
NELSON	5	0.5038	25%	0%	95%	29%	22%	75%	20%
NEW KENT	3	0.4445	1%	5%	70%	41%	29%	42%	0%
NEWPORT NEWS	36	0.2901	17%	35%	74%	42%	63%	68%	28%

Availability of distance learning technology in schools

Division	# of Schools Responding	Composite Index	% of classrooms Principals say are equipped with:			% of media centers, labs Principals say are equipped with:			We do not use distance learning in our school
			Phones	Computers connected to Internet	TV monitors and cable or antenna	Phones	Computers connected to Internet	TV monitors and cable or antenna	
NORFOLK	49	0.2905	8%	28%	92%	42%	44%	78%	47%
NORTHAMPTON	5	0.3129	1%	70%	63%	23%	68%	48%	20%
NORTHUMBERLAND	3	0.6365	50%	70%	100%	100%	18%	98%	0%
NORTON	2	0.3484	5%	95%	95%	50%	50%	100%	50%
NOTTOWAY	7	0.2563	20%	5%	76%	33%	67%	33%	57%
ORANGE	6	0.4245	2%	8%	5%	7%	10%	4%	50%
PAGE	8	0.3252	19%	2%	82%	18%	3%	55%	25%
PATRICK	7	0.3013	0%	25%	98%	25%	43%	59%	57%
PETERSBURG	8	0.2319	1%	1%	74%	40%	24%	79%	50%
PITTSYLVANIA	18	0.2868	16%	3%	91%	13%	35%	73%	28%
POQUOSON	4	0.3384	50%	100%	88%	57%	100%	88%	0%
PORTSMOUTH	24	0.2309	5%	33%	89%	34%	48%	76%	29%
POWHATAN	4	0.4131	28%	28%	51%	64%	51%	76%	25%
PRINCE EDWARD	3	0.3146	0%	0%	92%	17%	0%	92%	33%
PRINCE GEORGE	9	0.2736	0%	86%	93%	17%	90%	91%	22%
PRINCE WILLIAM	48	0.4158	21%	97%	89%	35%	86%	74%	38%
PULASKI	10	0.3184	3%	41%	64%	28%	38%	48%	60%
RADFORD	4	0.3412	3%	99%	99%	28%	98%	95%	50%
RAPPAHANNOCK	2	0.7089	15%	0%	55%	8%	3%	75%	50%
RICHMOND	3	0.3467	10%	73%	97%	10%	67%	93%	0%
RICHMOND CITY	41	0.4320	10%	48%	70%	38%	62%	70%	41%

Availability of distance learning technology in schools

Division	# of Schools Responding	Composite Index	% of classrooms Principals say are equipped with:			% of media centers, labs Principals say are equipped with:			We do not use distance learning in our school
			Phones	Computers connected to Internet	TV monitors and cable or antenna	Phones	Computers connected to Internet	TV monitors and cable or antenna	
ROANOKE	25	0.4280	5%	96%	82%	30%	83%	74%	44%
ROANOKE CITY	25	0.4157	24%	35%	68%	55%	58%	64%	36%
ROCKBRIDGE	7	0.4067	0%	79%	98%	24%	90%	89%	43%
ROCKINGHAM	17	0.3644	9%	83%	83%	38%	89%	89%	6%
RUSSELL	11	0.2520	3%	41%	97%	20%	29%	91%	45%
SALEM	5	0.4412	100%	96%	90%	100%	78%	88%	40%
SCOTT	14	0.2178	10%	6%	89%	24%	26%	91%	50%
SHENANDOAH	7	0.3966	3%	73%	71%	40%	65%	66%	29%
SMYTH	13	0.2678	1%	38%	70%	14%	32%	57%	31%
SOUTHAMPTON	7	0.3063	67%	37%	70%	36%	21%	36%	71%
SPOTSYLVANIA	23	0.3913	34%	50%	81%	39%	56%	79%	35%
STAFFORD	17	0.3530	60%	49%	98%	63%	51%	80%	47%
STAUNTON	5	0.4075	0%	56%	66%	49%	78%	73%	20%
SUFFOLK	13	0.3276	21%	53%	59%	19%	35%	49%	38%
SURRY	3	0.8000	35%	0%	72%	37%	4%	72%	67%
SUSSEX	5	0.3369	0%	0%	1%	42%	8%	9%	60%
TAZEWELL	17	0.2691	0%	8%	99%	15%	20%	93%	12%
VIRGINIA BEACH	77	0.3466	11%	12%	75%	27%	23%	69%	23%
WARREN	6	0.4073	38%	18%	96%	74%	37%	87%	50%
WASHINGTON	13	0.3287	3%	70%	73%	35%	61%	62%	31%
WAYNESBORO	3	0.3831	35%	100%	100%	33%	100%	66%	0%

Availability of distance learning technology in schools

Division	# of Schools Responding	Composite Index	% of classrooms Principals say are equipped with:			% of media centers, labs Principals say are equipped with:			We do not use distance learning in our school
			Phones	Computers connected to Internet	TV monitors and cable or antenna	Phones	Computers connected to Internet	TV monitors and cable or antenna	
WEST POINT	3	0.3327	7%	100%	100%	67%	67%	100%	33%
WESTMORELAND	2	0.3975	0%	100%	0%	0%	98%	0%	50%
WILLIAMSBURG	11	0.8000	100%	83%	99%	100%	85%	96%	27%
WINCHESTER	8	0.5439	27%	2%	83%	43%	12%	89%	38%
WISE	15	0.2245	2%	71%	75%	27%	71%	78%	13%
WYTHE	9	0.3163	3%	36%	89%	44%	40%	86%	22%
YORK	16	0.3894	8%	30%	77%	23%	26%	43%	38%

% of Principals saying their school has additional technology for live or delayed distance learning instruction	
63%	One-way video and audio (cable TV, satellite dish, microwave link)
21%	Internet-based distance learning
12%	One-way video, two-way audio (TV broadcast, live phone call from distant to central site)
10%	Two-way audio and video (video conference link between two sites)

% of Principals indicating these factors are significant barriers to increased use of educational technology in their schools.

Division	# of Schools Surveyed	Composite Index	Cost of purchasing computer hardware	Cost of computer and software upgrades, aging equipment	Cost of making building changes for technology (air conditioning, power)	Cost of ongoing system support (maintenance, repair)	Lack of time for training teachers to use computers	Cost of technical support for training of teachers/ staff
Statewide Average	**1634**	**0.3967**	**58%**	**53%**	**39%**	**39%**	**39%**	**31**
ACCOMACK	13	0.3185	31%	46%	15%	46%	46%	8
ALBEMARLE	18	0.6233	39%	33%	17%	28%	67%	33
ALEXANDRIA	16	0.8000	44%	44%	6%	6%	38%	0
ALLEGHANY	8	0.3157	38%	50%	63%	75%	38%	38
AMELIA	2	0.3334	100%	100%	50%	50%	50%	50
AMHERST	10	0.3168	60%	50%	20%	10%	10%	0
APPOMATTOX	3	0.2908	0%	33%	33%	33%	0%	0
ARLINGTON	26	0.8000	54%	58%	15%	8%	38%	19
AUGUSTA	18	0.3585	78%	61%	28%	72%	33%	44
BATH	3	0.8000	33%	0%	0%	0%	0%	0
BEDFORD	17	0.3942	82%	71%	47%	29%	47%	47
BLAND	3	0.2652	67%	0%	67%	33%	0%	33
BOTETOURT	11	0.3963	45%	36%	27%	45%	45%	45
BRISTOL	6	0.3613	33%	100%	33%	50%	17%	33
BRUNSWICK	5	0.2685	60%	40%	60%	0%	40%	20
BUCHANAN	13	0.2668	77%	54%	46%	31%	23%	31
BUCKINGHAM	6	0.2758	50%	67%	50%	83%	33%	50
BUENA VISTA	4	0.2501	75%	100%	25%	100%	25%	0
CAMPBELL	13	0.3010	38%	69%	23%	46%	38%	31
CAROLINE	4	0.3316	50%	0%	25%	25%	50%	25
CARROLL	10	0.2963	50%	40%	60%	30%	60%	50
CHARLES CITY	3	0.3756	33%	33%	0%	33%	33%	0

% of Principals indicating these factors are significant barriers to increased use of educational technology in their schools.

Division	# of Schools Surveyed	Composite Index	Cost of purchasing computer hardware	Cost of computer and software upgrades, aging equipment	Cost of making building changes for technology (air conditioning, power)	Cost of ongoing system support (maintenance, repair)	Lack of time for training teachers to use computers	Cost of technical support for training of teachers/ staff
CHARLOTTE	6	0.2510	17%	0%	17%	0%	17%	0
CHARLOTTESVILLE	9	0.5310	44%	56%	44%	78%	56%	56
CHESAPEAKE CITY	39	0.3560	38%	51%	23%	33%	38%	33
CHESTERFIELD	48	0.4062	75%	63%	44%	38%	33%	42
CLARKE	5	0.5241	80%	60%	40%	100%	20%	60
COLONIAL BEACH	1	0.3029	100%	100%	0%	100%	0%	0
COLONIAL HEIGHTS	5	0.4871	20%	20%	20%	80%	40%	60
COVINGTON	3	0.3475	0%	33%	33%	0%	33%	33
CRAIG	2	0.3215	100%	100%	100%	50%	0%	0
CULPEPER	7	0.4077	71%	86%	0%	86%	43%	71
CUMBERLAND	3	0.3342	67%	33%	33%	100%	33%	33
DANVILLE	14	0.3000	93%	43%	43%	50%	36%	21
DICKENSON	9	0.2443	78%	56%	56%	22%	11%	33
DINWIDDIE	6	0.2962	67%	33%	50%	33%	33%	50
ESSEX	2	0.4544	50%	0%	0%	0%	50%	0
FAIRFAX	179	0.7199	58%	51%	30%	34%	56%	47
FALLS CHURCH	2	0.8000	0%	0%	0%	0%	50%	0
FAUQUIER	14	0.6000	86%	86%	29%	29%	29%	0
FLOYD	4	0.3391	25%	50%	100%	50%	50%	25
FLUVANNA	5	0.3968	0%	0%	0%	0%	40%	0
FRANKLIN	14	0.3899	79%	64%	29%	57%	29%	21
FRANKLIN CITY	3	0.2883	67%	100%	33%	67%	33%	0
FREDERICK	15	0.3997	20%	33%	20%	33%	27%	20

% of Principals indicating these factors are significant barriers to increased use of educational technology in their schools.

Division	# of Schools Surveyed	Composite Index	Cost of purchasing computer hardware	Cost of computer and software upgrades, aging equipment	Cost of making building changes for technology (air conditioning, power)	Cost of ongoing system support (maintenance, repair)	Lack of time for training teachers to use computers	Cost of technical support for training of teachers/ staff
FREDERICKSBURG	3	0.6328	0%	0%	0%	0%	33%	0
GALAX	3	0.3608	33%	33%	0%	0%	0%	0
GILES	6	0.3197	100%	67%	0%	33%	17%	17
GLOUCESTER	9	0.3245	78%	44%	44%	56%	11%	22
GOOCHLAND	5	0.7975	20%	0%	0%	40%	20%	0
GRAYSON	11	0.2534	45%	55%	82%	18%	18%	9
GREENE	6	0.3177	50%	33%	17%	50%	50%	67
GREENSVILLE	2	0.2436	100%	50%	100%	50%	0%	50
HALIFAX	16	0.2380	69%	75%	44%	44%	25%	31
HAMPTON	28	0.2885	79%	57%	50%	36%	29%	29
HANOVER	18	0.4774	50%	67%	17%	11%	50%	17
HARRISONBURG	6	0.5477	17%	33%	33%	17%	83%	50
HENRICO	52	0.5225	29%	33%	21%	35%	10%	15
HENRY	16	0.3016	63%	56%	56%	25%	56%	13
HIGHLAND	2	0.5553	100%	50%	50%	50%	50%	0
HOPEWELL	6	0.2712	50%	50%	17%	33%	50%	33
ISLE OF WIGHT	8	0.3915	13%	38%	0%	13%	13%	0
KING GEORGE	2	0.3682	50%	50%	0%	100%	0%	0
KING QUEEN	1	0.4085	100%	100%	100%	100%	100%	0
KING WILLIAM	3	0.3811	67%	67%	67%	33%	33%	33
LANCASTER	3	0.6384	100%	67%	33%	67%	33%	33
LEE	12	0.1861	67%	83%	25%	75%	33%	17
LEXINGTON	2	0.4163	0%	100%	0%	100%	0%	0

% of Principals indicating these factors are significant barriers to increased use of educational technology in their schools.

Division	# of Schools Surveyed	Composite Index	Cost of purchasing computer hardware	Cost of computer and software upgrades, aging equipment	Cost of making building changes for technology (air conditioning, power)	Cost of ongoing system support (maintenance, repair)	Lack of time for training teachers to use computers	Cost of technical support for training of teachers/ staff
LOUDOUN	39	0.6776	8%	15%	21%	18%	36%	10
LOUISA	4	0.6626	25%	25%	25%	25%	50%	25
LUNENBURG	4	0.2346	25%	50%	100%	50%	50%	50
LYNCHBURG	19	0.3915	74%	53%	58%	26%	37%	16
MADISON	5	0.3919	40%	60%	40%	80%	40%	40
MANASSAS CITY	6	0.4557	17%	17%	17%	17%	0%	0
MANASSAS PARK	4	0.3388	25%	0%	25%	0%	0%	25
MARTINSVILLE	5	0.3294	60%	80%	60%	40%	20%	20
MATHEWS	3	0.4829	33%	67%	33%	33%	33%	67
MECKLENBURG	11	0.3329	82%	73%	91%	45%	55%	27
MIDDLESEX	3	0.5756	33%	0%	33%	0%	0%	0
MONTGOMERY	18	0.3744	83%	72%	44%	72%	67%	61
NELSON	5	0.5038	20%	40%	40%	0%	0%	0
NEW KENT	3	0.4445	67%	67%	67%	67%	33%	33
NEWPORT NEWS	36	0.2901	75%	47%	42%	44%	53%	42
NORFOLK	49	0.2905	69%	49%	63%	39%	59%	37
NORTHAMPTON	5	0.3129	80%	100%	0%	20%	0%	40
NORTHUMBERLAND	3	0.6365	67%	33%	67%	0%	0%	0
NORTON	2	0.3484	50%	100%	0%	0%	0%	0
NOTTOWAY	7	0.2563	100%	100%	0%	29%	29%	29
ORANGE	6	0.4245	83%	50%	67%	33%	33%	17
PAGE	8	0.3252	13%	13%	50%	13%	13%	0
PATRICK	7	0.3013	29%	29%	14%	14%	0%	14

% of Principals indicating these factors are significant barriers to increased use of educational technology in their schools.

Division	# of Schools Surveyed	Composite Index	Cost of purchasing computer hardware	Cost of computer and software upgrades, aging equipment	Cost of making building changes for technology (air conditioning, power)	Cost of ongoing system support (maintenance, repair)	Lack of time for training teachers to use computers	Cost of technical support for training of teachers/ staff
PETERSBURG	8	0.2319	50%	63%	50%	25%	13%	25
PITTSYLVANIA	18	0.2868	61%	67%	56%	39%	17%	39
POQUOSON	4	0.3384	50%	0%	75%	0%	25%	50
PORTSMOUTH	24	0.2309	79%	75%	67%	54%	42%	42
POWHATAN	4	0.4131	50%	75%	50%	0%	25%	25
PRINCE EDWARD	3	0.3146	0%	0%	0%	33%	33%	0
PRINCE GEORGE	9	0.2736	44%	44%	78%	33%	33%	22
PRINCE WILLIAM	48	0.4158	46%	44%	31%	29%	40%	27
PULASKI	10	0.3184	100%	80%	80%	70%	40%	30
RADFORD	4	0.3412	50%	75%	25%	50%	50%	0
RAPPAHANNOCK	2	0.7089	0%	0%	50%	50%	50%	0
RICHMOND	3	0.3467	0%	0%	67%	33%	0%	0
RICHMOND CITY	41	0.4320	63%	56%	46%	39%	32%	24
ROANOKE	25	0.4280	64%	72%	40%	52%	48%	48
ROANOKE CITY	25	0.4157	76%	80%	24%	48%	44%	28
ROCKBRIDGE	7	0.4067	57%	57%	14%	29%	43%	43
ROCKINGHAM	17	0.3644	82%	82%	41%	29%	47%	35
RUSSELL	11	0.2520	64%	73%	55%	64%	18%	9
SALEM	5	0.4412	20%	20%	20%	20%	20%	0
SCOTT	14	0.2178	50%	21%	71%	7%	14%	0
SHENANDOAH	7	0.3966	57%	57%	29%	14%	71%	14
SMYTH	13	0.2678	62%	54%	62%	31%	15%	8
SOUTHAMPTON	7	0.3063	71%	57%	57%	43%	43%	71

% of Principals indicating these factors are significant barriers to increased use of educational technology in their schools.

Division	# of Schools Surveyed	Composite Index	Cost of purchasing computer hardware	Cost of computer and software upgrades, aging equipment	Cost of making building changes for technology (air conditioning, power)	Cost of ongoing system support (maintenance, repair)	Lack of time for training teachers to use computers	Cost of technical support for training of teachers/ staff
SPOTSYLVANIA	23	0.3913	39%	26%	39%	39%	26%	30
STAFFORD	17	0.3530	35%	53%	41%	53%	47%	18
STAUNTON	5	0.4075	80%	60%	60%	40%	80%	40
SUFFOLK	13	0.3276	54%	38%	31%	31%	31%	38
SURRY	3	0.8000	0%	67%	33%	100%	67%	33
SUSSEX	5	0.3369	40%	40%	80%	20%	20%	20
TAZEWELL	17	0.2691	59%	59%	53%	29%	6%	6
VIRGINIA BEACH	77	0.3466	73%	52%	60%	51%	47%	36
WARREN	6	0.4073	50%	33%	50%	50%	33%	67
WASHINGTON	13	0.3287	62%	38%	15%	38%	54%	31
WAYNESBORO	3	0.3831	67%	67%	33%	33%	67%	33
WEST POINT	3	0.3327	0%	0%	0%	0%	0%	0
WESTMORELAND	2	0.3975	50%	0%	50%	0%	0%	0
WILLIAMSBURG	11	0.8000	9%	9%	9%	18%	45%	9
WINCHESTER	8	0.5439	75%	38%	25%	63%	0%	38
WISE	15	0.2245	53%	47%	40%	40%	20%	27
WYTHE	9	0.3163	78%	67%	56%	67%	11%	33
YORK	16	0.3894	63%	63%	19%	75%	50%	69

Less frequently mentioned "significant" barriers, along with the average percent of principals selecting them were the following:

23% Out-of-date telephone service to our school
18% Lack of textbooks that integrate the use of technology
16% Lack of computer skills/expertise among teachers
8% Difficulty in finding computer software to match instructional needs
6% Lack of computer skills/expertise among students
4% Lack of community support (business, foundations)
3% Lack of teacher support or interest
3% Lack of administrative/school board support

Principal Ratings of Computer Use and Emphasis by Divisions

Division	# of Schools Responding	Composite Index	% of Principals indicating technology is "extremely" well integrated into learning	% of Principals saying students use computers 60 minutes or more per week for learning	% of teachers Principals indicated using computers for teaching	% of Principals saying "substantial" emphasis has been placed on teacher training in:		% of Principals rating access to computers as "one of the top priorities"
						Basic Computer Operation Skills	Using Computers to Increase Student Learning	
Statewide Average	**1634**	**0.3967**	**15%**	**33%**	**63%**	**54%**	**39%**	**59%**
ACCOMACK	13	0.3185	0%	8%	42%	31%	0%	46%
ALBEMARLE	18	0.6233	6%	17%	60%	11%	22%	39%
ALEXANDRIA	16	0.8000	25%	31%	64%	56%	44%	56%
ALLEGHANY	8	0.3157	13%	88%	53%	38%	25%	75%
AMELIA	2	0.3334	50%	0%	70%	100%	100%	0%
AMHERST	10	0.3168	20%	40%	69%	80%	80%	80%
APPOMATTOX	3	0.2908	0%	0%	33%	67%	33%	100%
ARLINGTON	26	0.8000	27%	38%	76%	73%	81%	65%
AUGUSTA	18	0.3585	6%	28%	55%	33%	22%	56%
BATH	3	0.8000	0%	67%	63%	100%	67%	33%
BEDFORD	17	0.3942	0%	12%	56%	18%	12%	41%
BLAND	3	0.2652	67%	100%	58%	67%	33%	33%
BOTETOURT	11	0.3963	0%	36%	73%	36%	27%	18%
BRISTOL	6	0.3613	0%	33%	27%	67%	33%	50%
BRUNSWICK	5	0.2685	0%	20%	52%	80%	60%	60%
BUCHANAN	13	0.2668	15%	54%	45%	62%	23%	69%
BUCKINGHAM	6	0.2758	17%	33%	68%	83%	50%	50%
BUENA VISTA	4	0.2501	25%	0%	49%	100%	75%	100%
CAMPBELL	13	0.3010	0%	54%	59%	46%	46%	38%

Principal Ratings of Computer Use and Emphasis by Divisions

Division	# of Schools Responding	Composite Index	% of Principals indicating technology is "extremely" well integrated into learning	% of Principals saying students use computers 60 minutes or more per week for learning	% of teachers Principals indicated using computers for teaching	% of Principals saying "substantial" emphasis has been placed on teacher training in:		% of Principals rating access to computers as "one of the top priorities"
						Basic Computer Operation Skills	Using Computers to Increase Student Learning	
CAROLINE	4	0.3316	0%	0%	88%	25%	50%	75%
CARROLL	10	0.2963	10%	30%	48%	40%	20%	50%
CHARLES CITY	3	0.3756	0%	0%	12%	33%	33%	100%
CHARLOTTE	6	0.2510	50%	100%	90%	100%	17%	67%
CHARLOTTESVILLE	9	0.5310	11%	11%	64%	0%	0%	44%
CHESAPEAKE CITY	39	0.3560	10%	21%	51%	46%	44%	49%
CHESTERFIELD	48	0.4062	8%	31%	60%	60%	50%	65%
CLARKE	5	0.5241	0%	60%	51%	100%	20%	60%
COLONIAL BEACH	1	0.3029	0%	0%	20%	100%	0%	0%
COLONIAL HEIGHTS	5	0.4871	0%	0%	59%	60%	40%	60%
COVINGTON	3	0.3475	0%	0%	61%	67%	0%	33%
CRAIG	2	0.3215	0%	0%	43%	50%	0%	50%
CULPEPER	7	0.4077	0%	0%	39%	0%	0%	43%
CUMBERLAND	3	0.3342	0%	0%	30%	100%	33%	100%
DANVILLE	14	0.3000	14%	21%	63%	14%	36%	50%
DICKENSON	9	0.2443	44%	22%	55%	100%	78%	67%
DINWIDDIE	6	0.2962	0%	17%	28%	67%	17%	33%
ESSEX	2	0.4544	0%	50%	40%	0%	0%	0%
FAIRFAX	179	0.7199	22%	41%	76%	60%	44%	61%
FALLS CHURCH	2	0.8000	0%	100%	83%	50%	0%	50%

Principal Ratings of Computer Use and Emphasis by Divisions

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						Basic Computer Operation Skills	Using Computers to Increase Student Learning	
FAUQUIER	14	0.6000	14%	43%	68%	36%	29%	43%
FLOYD	4	0.3391	25%	25%	85%	100%	50%	75%
FLUVANNA	5	0.3968	0%	20%	90%	20%	20%	60%
FRANKLIN	14	0.3899	14%	57%	59%	71%	57%	50%
FRANKLIN CITY	3	0.2883	0%	33%	80%	100%	67%	33%
FREDERICK	15	0.3997	7%	20%	77%	87%	47%	53%
FREDERICKSBURG	3	0.6328	33%	33%	72%	100%	67%	67%
GALAX	3	0.3608	33%	67%	73%	67%	33%	0%
GILES	6	0.3197	17%	33%	55%	83%	67%	50%
GLOUCESTER	9	0.3245	0%	22%	52%	56%	22%	56%
GOOCHLAND	5	0.7975	40%	60%	67%	100%	100%	40%
GRAYSON	11	0.2534	0%	27%	56%	45%	36%	64%
GREENE	6	0.3177	0%	33%	71%	33%	17%	50%
GREENSVILLE	2	0.2436	0%	0%	33%	50%	50%	0%
HALIFAX	16	0.2380	25%	56%	66%	31%	19%	69%
HAMPTON	28	0.2885	7%	18%	68%	68%	43%	75%
HANOVER	18	0.4774	28%	44%	89%	50%	33%	50%
HARRISONBURG	6	0.5477	0%	83%	70%	33%	0%	50%
HENRICO	52	0.5225	40%	69%	90%	67%	75%	56%
HENRY	16	0.3016	13%	63%	64%	63%	19%	63%

Principal Ratings of Computer Use and Emphasis by Divisions

Division	# of Schools Responding	Composite Index	% of Principals indicating technology is "extremely" well integrated into learning	% of Principals saying students use computers 60 minutes or more per week for learning	% of teachers Principals indicated using computers for teaching	% of Principals saying "substantial" emphasis has been placed on teacher training in:		% of Principals rating access to computers as "one of the top priorities"
						Basic Computer Operation Skills	Using Computers to Increase Student Learning	
HIGHLAND	2	0.5553	0%	0%	50%	0%	0%	100%
HOPEWELL	6	0.2712	17%	17%	67%	83%	50%	67%
ISLE OF WIGHT	8	0.3915	50%	25%	73%	63%	50%	38%
KING GEORGE	2	0.3682	50%	0%	60%	50%	50%	100%
KING QUEEN	1	0.4085	100%	0%	30%	100%	100%	100%
KING WILLIAM	3	0.3811	0%	0%	42%	100%	67%	33%
LANCASTER	3	0.6384	0%	67%	40%	67%	33%	100%
LEE	12	0.1861	17%	25%	40%	67%	50%	42%
LEXINGTON	2	0.4163	0%	0%	63%	50%	50%	0%
LOUDOUN	39	0.6776	13%	41%	75%	51%	51%	95%
LOUISA	4	0.6626	0%	25%	55%	100%	75%	75%
LUNENBURG	4	0.2346	25%	0%	68%	100%	100%	100%
LYNCHBURG	19	0.3915	16%	74%	81%	74%	53%	53%
MADISON	5	0.3919	20%	20%	48%	0%	0%	20%
MANASSAS CITY	6	0.4557	17%	17%	73%	83%	50%	100%
MANASSAS PARK	4	0.3388	0%	25%	58%	50%	75%	75%
MARTINSVILLE	5	0.3294	0%	40%	60%	40%	40%	60%
MATHEWS	3	0.4829	0%	0%	65%	67%	33%	67%
MECKLENBURG	11	0.3329	18%	27%	36%	36%	36%	45%
MIDDLESEX	3	0.5756	33%	33%	90%	100%	33%	0%

Principal Ratings of Computer Use and Emphasis by Divisions

Division	# of Schools Responding	Composite Index	% of Principals indicating technology is "extremely" well integrated into learning	% of Principals saying students use computers 60 minutes or more per week for learning	% of teachers Principals indicated using computers for teaching	% of Principals saying "substantial" emphasis has been placed on teacher training in:		% of Principals rating access to computers as "one of the top priorities"
						Basic Computer Operation Skills	Using Computers to Increase Student Learning	
MONTGOMERY	18	0.3744	6%	17%	60%	33%	28%	33%
NELSON	5	0.5038	20%	20%	77%	80%	20%	60%
NEW KENT	3	0.4445	33%	33%	63%	67%	33%	100%
NEWPORT NEWS	36	0.2901	8%	25%	45%	44%	28%	53%
NORFOLK	49	0.2905	12%	24%	54%	29%	33%	73%
NORTHAMPTON	5	0.3129	20%	20%	78%	100%	100%	80%
NORTHUMBERLAND	3	0.6365	0%	33%	48%	67%	33%	67%
NORTON	2	0.3484	50%	0%	10%	50%	0%	100%
NOTTOWAY	7	0.2563	14%	14%	60%	0%	0%	29%
ORANGE	6	0.4245	0%	0%	47%	17%	0%	33%
PAGE	8	0.3252	38%	63%	68%	75%	25%	63%
PATRICK	7	0.3013	0%	71%	69%	86%	71%	71%
PETERSBURG	8	0.2319	0%	13%	34%	25%	25%	63%
PITTSYLVANIA	18	0.2868	11%	28%	50%	89%	83%	61%
POQUOSON	4	0.3384	0%	50%	88%	100%	75%	75%
PORTSMOUTH	24	0.2309	0%	13%	55%	33%	17%	58%
POWHATAN	4	0.4131	25%	25%	43%	100%	50%	50%
PRINCE EDWARD	3	0.3146	0%	67%	60%	0%	0%	67%
PRINCE GEORGE	9	0.2736	0%	0%	60%	67%	11%	33%
PRINCE WILLIAM	48	0.4158	21%	25%	66%	48%	25%	46%
PULASKI	10	0.3184	10%	0%	34%	70%	50%	70%

Principal Ratings of Computer Use and Emphasis by Divisions

Division	# of Schools Responding	Composite Index	% of Principals indicating technology is "extremely" well integrated into learning	% of Principals saying students use computers 60 minutes or more per week for learning	% of teachers Principals indicated using computers for teaching	% of Principals saying "substantial" emphasis has been placed on teacher training in:		% of Principals rating access to computers as "one of the top priorities"
						Basic Computer Operation Skills	Using Computers to Increase Student Learning	
RADFORD	4	0.3412	25%	25%	64%	100%	0%	75%
RAPPAHANNOCK	2	0.7089	0%	0%	43%	0%	0%	50%
RICHMOND	3	0.3467	0%	33%	52%	67%	67%	100%
RICHMOND CITY	41	0.4320	15%	32%	52%	37%	27%	61%
ROANOKE	25	0.4280	8%	8%	69%	68%	28%	56%
ROANOKE CITY	25	0.4157	24%	44%	66%	36%	32%	48%
ROCKBRIDGE	7	0.4067	14%	29%	64%	14%	29%	43%
ROCKINGHAM	17	0.3644	29%	82%	73%	59%	29%	47%
RUSSELL	11	0.2520	18%	64%	52%	36%	9%	91%
SALEM	5	0.4412	0%	20%	71%	60%	60%	60%
SCOTT	14	0.2178	29%	50%	70%	86%	64%	57%
SHENANDOAH	7	0.3966	0%	14%	33%	43%	29%	29%
SMYTH	13	0.2678	8%	31%	53%	77%	54%	62%
SOUTHAMPTON	7	0.3063	14%	29%	63%	43%	29%	57%
SPOTSYLVANIA	23	0.3913	4%	26%	62%	30%	22%	48%
STAFFORD	17	0.3530	0%	24%	61%	59%	59%	53%
STAUNTON	5	0.4075	0%	20%	70%	60%	0%	20%
SUFFOLK	13	0.3276	8%	8%	45%	31%	23%	54%
SURRY	3	0.8000	0%	33%	58%	33%	0%	100%
SUSSEX	5	0.3369	40%	40%	71%	0%	0%	60%
TAZEWELL	17	0.2691	6%	12%	61%	59%	24%	71%

Principal Ratings of Computer Use and Emphasis by Divisions

Division	# of Schools Responding	Composite Index	% of Principals indicating technology is "extremely" well integrated into learning	% of Principals saying students use computers 60 minutes or more per week for learning	% of teachers Principals indicated using computers for teaching	% of Principals saying "substantial" emphasis has been placed on teacher training in:		% of Principals rating access to computers as "one of the top priorities"
						Basic Computer Operation Skills	Using Computers to Increase Student Learning	
VIRGINIA BEACH	77	0.3466	14%	22%	62%	25%	18%	71%
WARREN	6	0.4073	0%	33%	69%	50%	33%	83%
WASHINGTON	13	0.3287	8%	8%	44%	31%	23%	54%
WAYNESBORO	3	0.3831	0%	33%	67%	67%	33%	100%
WEST POINT	3	0.3327	0%	100%	87%	100%	100%	67%
WESTMORELAND	2	0.3975	0%	0%	43%	100%	50%	100%
WILLIAMSBURG	11	0.8000	18%	45%	60%	27%	27%	36%
WINCHESTER	8	0.5439	13%	63%	76%	75%	63%	63%
WISE	15	0.2245	7%	33%	49%	80%	33%	67%
WYTHE	9	0.3163	0%	33%	64%	33%	33%	67%
YORK	16	0.3894	13%	38%	57%	31%	19%	50%
	1634							

Data Collection Instrumentation

Questions Asked

Summary/Overview: Please summarize key features of this site in a few sentences.

Q. Background

What is the nature of the school division (district), in terms such as the total number of students, the number of schools, and the nature of the population?

What is the nature of the school, in terms such as the nature of the population, its location, size, and leadership?

1. Learners

a) What are the perceived impacts of technology use on students, with regard to the Virginia SOLs or in other ways? (Break out by discipline, if appropriate.)

b) Is there evidence that the students are competent and confident in their own ability to use the technology? Does this vary according to the type of technology applications? (Looking for levels of student fluency/proficiency)

c) Is there evidence that students are using the technology to apply the academic subjects to relevant, real world applications (e.g, working with field experts; developing products, services or solutions for the community; accessing primary data sources and/or systems like weather maps or GIS systems)?

d) Is there evidence that the use of the technology increases students' motivation to learn within the content areas (e.g., quality of student products, higher interest level or excitement about content, time on task, tone of classroom, level of discussion)?

e) Does the school require all students and their parents to sign and adhere to an acceptable use policy for technology, email or Internet use? Is there evidence that such policies are in force (e.g., posting of signs about acceptable use, student/teacher knowledge of policy)?

2. Learning Environments

a) Is technology used in the curriculum to any extent? If so, what technologies (specific software, if known), how, and how often?

b) Is there evidence (e.g., student products, teacher lesson or unit plans, observed activities) that technology is an integral part of the day-to-day teaching and learning of students and teachers?

c) Is there evidence that technology has increased levels of collaboration between members of the school community: teachers, students, parents, community resources, etc. (E.g., collaborative planning by teachers, increased use of collaborative learning with students, opportunities for students to collaborate with students in other schools or outside resource persons.)

d) What evidence is there that administrators and teachers are regular users of technology? (E.g., examples of teacher technology products such as documents or Hyperstudio instructional stacks, teachers presenting with technology, administrators communicating electronically)

e) Discuss the use of technology in mathematics; use examples, if possible.

f) Discuss the use of technology in science; use examples, if possible.

g) Discuss the use of technology in English/language arts; use examples, if possible.

h) Discuss the use of technology in history / social studies; use examples, if possible.

i) What evidence is there that technology is changing the roles of teachers or students in any significant way? (E.g., students as instructors of other students or teachers, teachers as co-learners, teacher as guide rather than directing activity, students as creators rather than consumers of knowledge.)

j) What evidence is there that technology has changed the way in which teachers and learners communicate? (E.g., is email a primary means of communication within the district and/or between school and home? Do students have regular access to resource people outside the classroom?)

k) What barriers do teachers perceive to greater availability/use of technology for instruction?

l) What barriers do principals and/or technology specialists perceive?

3. Professional Competency

a) How well prepared are teachers to use technology? Is there evidence that teachers are fluent in the use of technology for their own professional purposes as well as in teaching by content area? Does teacher professional development in technology seem to be a high priority here? Is it being done well?

b) Are teachers using technology to support their own professional and collegial practice?

c) Are teachers evidencing the ability to organize classrooms and instruction to maximize the positive effects of technology. (For example, does the physical arrangement of the classroom support small-group and collaborative use of technology? Does the teacher's organization of class activity allow for different students doing different things at different times.)

4. System Capacity

a) How adequate is funding for technology (hardware, software, network, maintenance, training, professional development, curriculum design)?

b) What role does district/school/department leadership play in technology?

c) Is software included as an acceptable expenditure under the traditional categories of instructional resource and/or textbook adoptions?

d) Is there a district technology coordinator and/or a school building technology coordinator who supports teachers in using technology in their classrooms?

e) Does the building or district provide professional development activities on technology? Are they directly tied to curriculum, instruction and technology in the building?

f) Are teachers and the principal knowledgeable about the technology plan for the district and/or building?

g) Is technology a factor in decision making in the building (e.g., included in the definition of instructional resources, included under textbook adoptions, used to facilitate interaction among teachers, electronic communications are the norm, an integral component for all learning environments and community programs)?

5. Community Connections

a) What has been the role of the community (e.g., supporting school bonds, membership in advisory groups, attitudes toward technology)?

b) Does the community benefit from the technology implementation? (Student projects, community access to labs, parental access to online information, etc.)

c) Have new partnerships or linkages between the school and community been established as a result of technology?

6. Technology Capacity

a) Give a brief summary of the technology capacity of the school (including where computers are actually located).

b) Is the network infrastructure sufficient to give teachers and students access to school, district, and internet based resources where appropriate?

c) What forms of technical support are available to teachers and students, if any?

d) Do all parties in the school perceive technology to be conveniently located to support classroom learning?

e) Does the school building appear to be well designed or modified to support technology-rich classrooms?

f) Do teachers feel high levels of satisfaction with the available support?

7. Accountability

a) What do principals and teachers think of SOL technology standards/tests?

b) What are teachers expecting to accomplish through their use of technology in the content areas? What evidence are they collecting to document those accomplishments?

8. Issues Raised at This Site (optional)

a) What key issues are raised by your visit to this site? Why are these key issues?

Site Visit Sample Letter to a Principal

September 18, 1998
Ms. PRINCIPAL'S NAME
SCHOOL NAME
SCHOOL ADDRESS
CITY, VA ZIP

Dear Principal LAST NAME:

We are writing to request permission for members of the SRI/Milken/NCREL study team to conduct a site visit to your school as part of a study for the Virginia General Assembly about technology use in the schools. As you know from Dr. Stapleton's letter, the Virginia Department of Education has commissioned a consortium—SRI International, the Milken Exchange on Education Technology, and the North Central Regional Educational Laboratory (NCREL)—to survey principals and teachers and also to visit schools throughout the state. The study team has selected a sample of 48 schools carefully balanced in terms of geographic location, urban/ suburban/rural status, and amount of available technology, and yours is one of these schools.

The burden on you or any teacher in the school will be small because 1 or 2 researchers will talk with and visit a number of different people over the course of about half a day. It would be unusual for a visitor to spend even a full hour with any individual, and typically the time involved for anyone in the schools will be less than that (such as one class period). No special preparation is needed, although we would like you to complete in advance the survey that is being sent to all principals in the state.

Because very tight timetables have been established for this study, the on-site visits in your area are scheduled soon, during the week of September 28, 1998. The leader of the site visit team in your area, LEAD RESEARCHER'S NAME, will be contacting you within the next few days to ask for your help in setting a date and time for a visit.

We appreciate your assistance in making this important study a success. If you have any questions about the study, feel free to call either of us.

Sincerely,

Andrew A. Zucker	Lan W. Neugent
Program Manager	Assistant Superintendent for Technology
SRI International	Virginia Department of Education
(703) 247-8523	(804) 225-2757

VA Technology Study Focus Groups

Teacher/Administrator Protocol

(Facilitators: Italics indicate examples of facilitator notes for addressing participants – feel free to improvise, but try to keep the general idea in focus)

NOTE: Since the RFP specifically states that we should focus on RECOMMENDATIONS for the Six Year Plan, PLEASE MAKE SURE TO COVER QUESTION 5 (Accountability) – MAKE SURE YOU LEAVE ENOUGH TIME TO COVER THIS ISSUE – THANKS!

I. Have participants sign-in when they arrive (we need their addresses to mail the $50 check for their participation). Have them fill out a "tent" with their name AND role.

II. Welcome, overview and topic.

Provide consistent background information to each participant about the purpose of the study so that they have a grounding for the focus group questions. (This information will be provided when the participants are invited and also in the follow-up letter, but must also be provided at the start of the focus group session):

Focus group team introductions (outside researchers) and discussion of the study

"The Virginia Department of Education has commissioned a consortium of education organizations (Milken Exchange on Technology; North Central Regional Educational Laboratory; SRI International) to conduct an analysis of the status of educational technology availability and usage in Virginia's public schools. The goal of the study includes determining:

- the availability of technologies to help students to meet the technology Standards of Learning;
- the availability and type of technology available for instructional activities on a daily basis;
- the use of technology within the curriculum;
- and the training available to classroom teachers.

The study is framed around the Milken Exchange's Seven Dimensions of Progress. The Seven Dimensions provides a comprehensive framework for not only looking at the impact of technology applications on student learning, but analyzing how an education system is doing in providing the essential conditions that must be in place to bring technology-enriched learning opportunities to students, systematically and equitably. You were sent a copy of the Seven Dimensions in your participant packet – does everyone have a copy of that? (Distribute a copy to anyone missing his or her copy but collect again at the end of the session.)

To date, we have conducted surveys of all Virginia K-12 schools (some of you here may have participated in the survey) as well as site visits to 48 schools across the state.

We are also conducting several focus groups across the different regions of the state with teachers and administrators from elementary, middle and high schools. The purpose of these focus group discussions is to collect information on educator perceptions, knowledge, opinions, and attitudes about education technology in general and, more specifically, how it relates to educating children in Virginia. Information collected from these focus groups, along with the survey and site visit data, will be used to set direction for Virginia's education technology plan, to inform policymakers of the perspectives and experiences of a cross-section of Virginia schools and educators, and to identify areas for program and policy improvement and development.

Present "ground rules" such as the objective here is research for understanding and improving, not sales; information provided is confidential and no names will be used in reporting; discussion will be tape recorded and therefore need to ensure that only one persons speaks at a time; we are just as interested in negative comments as positive ones; session will last about 90 minutes and we will not be taking any formal breaks so feel free to leave the discussion is you wish to stretch or use the restrooms which are located.....

Introductions: Place name cards on the table in front of each participant and start with first question....

Questioning Route

The first question is designed to engage all participants one at a time in the group discussion. It "breaks the ice," allows each participant to introduce themselves and gets each participant to talk.

"Ice-breaker"

"We've placed name cards on the table in front of you to help us remember each other's names. First I'd like each of you to introduce yourself and I'd like each of you to tell me the first thing that comes to your head when you hear the words "technology in education" (Go around the table and make sure everyone gives a response before proceeding with question 2)

You're going to have to improvise here but should be something that moves into discussion of the 7 dimensions like:

Dimension 4: System Capacity

A lot of what we are hearing has to do with a vision and plan for technology; access to technology; training and technical assistance in using technology; competing demands, etc. I'd like to start to talk about some of these issues. In your experiences, is there a statewide vision for technology in education?" (Anyone who has a response, just chime in....)

Probe: If no, why not? If yes, what is that vision? Is this vision realistic? Have the range of stakeholders been involved in defining the vision and was this involvement "authentic"? Do you think there is consensus or at least some agreement among educators across the state on this vision? How has it been communicated to educators across the state?

Is there alignment between this vision for technology in schools and existing state educational policies and practices? If so, where are the conflicts?

What kind of job has the state done in translating this vision for technology into realistic benchmarks, guidelines, etc. for divisions and schools in terms of technology integration? What else is needed from the state to help divisions and schools to translate the vision into reality?

Have state policies, actions and funding been the driving force in bringing technology to your school(s) or are there other reasons? (If the latter, probe for those other catalysts.)

Dimension 6: Technology Capacity

Given the vision and goals for education technology in Virginia, do you think Virginia schools have the technology capacity and infrastructure to achieve these goals? In other words, are they "technology ready" with respect to such things as technology equipment, connectivity, technical support?

Probe: *If no, what does the "ideal" infrastructure look like? What specifics are needed in terms of equipment, facility, software, etc.? What kind of technical support staffs are needed at the division and school level?*

What are the barriers to building such an infrastructure? How can schools overcome these barriers – what support and resources are needed and who should provide them?

Overall, how far off are schools from this ideal – for example, if the ideal was a 10 (on a 1 to 10 scale), where would you rank Virginia schools in terms of technology capacity?

If yes, what does the infrastructure look like / what are the core components (e.g., equipment, facility, software, technical support staff)?

Dimensions 1, 2, & 3: Learners, Learning Environments, Professional Competency

We've just talked about some elements of the physical infrastructure that you believe need to be in place to move toward state technology goals, but there's also the "human infrastructure" dimension that needs to be considered and I like to spend some time talking about this.

Given the vision and plans for integrating technology into the learning environment, what would an ideal (ELEMENTARY/MILLDE/HIGH SCHOOL) *classroom environment where technology is optimally integrated into teaching and learning look like? FOR EXAMPLE: What would the classroom set-up look like? What would teachers look like/how would they be teaching? What would student learning look like? What types of activities would they be involved with? What kinds of interactions would be taking place?*

Let participants think about this and brainstorm for a few minutes, once they have thrown around some ideas of what this environment would look like, move on to…

Again, overall, how far off are Virginia schools from this ideal – for example, if the ideal was a 10 (on a 1 to 10 scale), where would you rank Virginia schools in terms of an integrated technology learning environment?

What is needed to get there?

Probe: *What skills and knowledge do educators need to operate in this type of teaching and learning environment? What are the barriers or what prevents educators from obtaining these skills? What resources are needed and from where should these resources come? How and how well is the state facilitating professional competency opportunities for educators? What else is needed?*

What are some educator outcomes with respect to using technology in the learning environment? Is there evidence of changes in attitude, behavior, and practice? What is the evidence?

What do you believe can be the impact of technology use on student learning? Based on your experience and observations, what are some student outcomes with respect to using technology in the learning environment?

Do you thing the Virginia Standards of Learning as they relate to technology are adequate? Are they feasible? Are they the right way to be measuring technology goals?

Dimension 7: Accountability

In your packet we sent you an executive summary of the Virginia Six Year Plan for Technology in Education. I'd like to briefly touch upon this document. If you could take a look at the goals on page 3 of that document. If you don't have the document with you, I have copies of that page…

What is your opinion about these goals?

Probe: *Are they adequate? Are they moving in the right direction? Are they realistic?*

What recommendations would you make to the state with regards to such things as strategies for attaining these goals, measuring progress toward these goals, and communicating these goals to the education community and the Virginia community at large?

Concluding the Discussion

We've talked about some really important issues and you've provided some critical insights for us to consider as we analyze all the data collected and provide recommendations to the state. In concluding our discussion today, I'd like to pose to each of you one final question:

What is the one piece of advice you would give to the Commonwealth of Virginia to assist you and your community in effectively accessing and using technology?

Focus Group Reports

Outline

The focus group component of this study is used to supplement the survey data but it also has a strong focus on informing the recommendation section of the report. It is the one study component that directly asks respondents for suggestions, advice and recommendations around access and use of education technology. So keep that in mind when writing up the focus group reports.

The reports should be no more than 5-6 pages max, so please keep a focus on the most critical information collected.

Following is a loose outline for you to follow. I'd like the reports to align with the protocol as much as possible and I'd like you to provide illustrative quotations and include with them the role of the person who made the statement (e.g., elementary school teacher; high school principal; elementary technology coordinator, etc.)

Snapshot of Participants
Number attending

Make-up (# teachers, administrators, etc.)

Your initial perception about their knowledge about and buy-in/support for ed. technology (draw from the "ice-breaker" question)

Summation of Discussion
Please provide a brief summation of the discussion that includes the "tone" of the discussion, the direction it took, the "intensity" level around the issue of ed technology (e.g., was it a "love feast" or was there a balance between supporters/skeptics, etc.); trends; and the overall outcomes of the discussion.

Dimension 4: System Capacity
Please provide a summary of the "vision" discussion and key recommendations (direct and indirect) offered by the group. Provide key quotations.

Dimension 6: Technology Capacity
Similar to III, but also provide a summation of the "ideal" infrastructure according to the group Indicate barriers toward reaching that infrastructure as well as recommendations (direct and indirect) for the state.

Dimension 1, 2, 3: Learners, Learning Environments, ...
Similar to IV with a summation of the "ideal" learning environment, gaps to getting there and recommendations for the state.

Advice to State...
Summary of the final question, clustered around themes (e.g., "8 of 10 participants mentioned issues around the need to focus on equity in funding...")

Sample Invite to Division Superintendent

December 24, 1998

To: Superintendent «LastName»
«Company» Public Schools

Fax: «Address1»

We are writing to request your help in selecting principals and teachers from across your division's elementary schools to serve as participants in a focus group as part of the study for the Virginia General Assembly about technology use in the schools.

As you know from Superintendent Stapleton's letter of August 28, 1998, the Virginia Department of Education has commissioned a consortium—the Milken Exchange on Education Technology, the North Central Regional Educational Laboratory (NCREL), and SRI International—to conduct an analysis of the status of educational technology availability and usage in the public schools of Virginia. An important component of this study is discussing with educators in a focus group format the role of technology in education—where schools are now and where they want to be in the next century. This study provides a unique opportunity for principals and teachers to help inform and shape recommendations for the State to better implement the Six Year Educational Technology Plan for Virginia.

Your assistance in helping to recruit participants for this focus group would be much appreciated. We would like representation from principals and teachers from across your division's elementary schools. These participants will be meeting with educators from neighboring divisions. Participants of this focus group will receive $50 as a way of saying thank you for their time and effort.

Because of the tight timetable for completing this study, the focus group is scheduled for October XX, 1998 from 4:00 – 6:00 p.m. A member of the focus group research team will be contacting you within the next few days to ask for your help in recruiting participants for this focus group.

We appreciate your assistance in making this important study a success. If you have any questions about this study, feel free to call either of us.

Sincerely,

Shannon B. Cahill
Project Manager
847-492-8342

Lan W. Neugent
Assistant Superintendent for Technology
Virginia Department of Education
804-225-2757

Sample Participant Invite

(Printed on VDOE Letterhead)

December 24, 1998

Name
Benjamin Syms Middle School

Thank you for accepting our invitation to attend the educator focus group as part of the Virginia Technology Study. Your superintendent recommended you to be a participant in this focus group discussion and we look forward to meeting with you and other educators in the area. The focus group discussion will take place at:

Norfolk Tech Vocational Center – 1330 N. Military Highway
on October 19, 1998
starting at 4:00 p.m. and finishing at about 6:00 p.m.

The discussion you will be attending is one component of a larger statewide study conducted by the Virginia Department of Education. The focus of the study is on the status of educational technology availability and usage in Virginia's public schools. The goals of the study includes determining the availability of technologies to help students meet the technology Standards of Learning; the availability and type of technology available for instructional activities on a daily basis; the use of technology within the curriculum; and the training available to classroom teachers. We will be asking for your input and recommendations around these issues as part of the on-going refinement of the state's Six Year Educational Technology Plan.

Enclosed you will find some background materials for your review: The executive summary to the Six-Year Educational Technology Plan for Virginia and the Seven Dimensions of Technology Progress (a document that is being used to frame many of the issues in this study).

As a small token of our appreciation for your participation in this study and to cover your expenses in attending the focus group, we will mail you a check for $50.00 at the conclusion of the study.

If you cannot attend, please notify Liz Cornell at NCREL (one of the research organizations conducting the study for the Virginia Department of Education) at 1-800-356-2735.

We look forward to seeing you on October 19, 1998.

Sincerely,

Shannon Cahill, Ph.D.
Study Consultant & Principal Investigator
Phone: 847-492-8341

COMMONWEALTH of VIRGINIA
DEPARTMENT OF EDUCATION
P.O. BOX 2120
RICHMOND 23218-2120

September 3, 1998

«TITLE» «FIRST» «MIDDLE» «LAST» «EXT»
«SCHOOL»
«STREET_ADDRESS1»
«STREET_ADDRESS2»
«CITY», VA «ZIP»

Dear Principal «LAST»:

I am writing to request your help in measuring the progress and setting the course for future Virginia educational technology initiatives. As you may be aware, approximately $120 million has been allocated by the state for educational technology since 1996. These funds have been used for infrastructure, classroom computers, and local plan options with the objective of providing tools to help instructors teach more effectively and students learn more efficiently. To assess the value of this investment, the General Assembly directed the Department of Education to conduct a survey of all Commonwealth schools concerning the availability and use of educational technologies. Specifically, this study is a way to discover how the use of technology benefits students and how it affects both the learning environment and professional development opportunities for teachers. The survey also will ask you what additional support is needed for effective use. We have selected a consortium of three nationally recognized organizations to conduct the study: the Milken Exchange on Education Technology, the North Central Regional Educational Laboratory, and SRI International.

During the next few days, you will receive a survey that you or your designee should complete. I realize that this comes as you and your staff are in the process of beginning the school year, but I trust that you will be able to set aside some time to complete this important survey. I would greatly appreciate it if you could return the survey within the week that you receive it. Because the time available to conduct the survey is very short, we are taking the extraordinary steps of express delivering this letter to you as well as express delivering the survey. If you have any questions about the survey, contact Dr. Shannon Cahill, study director, toll free at (800) 356-2735, ext.1280.

Findings and recommendations from this study will be presented to Governor Gilmore and members of the Virginia General Assembly for their consideration in planning future technology initiatives. Findings will also be reported through the department of education's Internet site (www.pen.k12.va.us).

Thank you for taking time out of your busy schedule to help us with this important task.

Sincerely,

Lan W. Neugent
Assistant Superintendent for Technology
(804) 225-2757

General sample

NCREL
North Central Regional Educational Laboratory
"Applying Research and Technology to Learning"

September 16, 1998

«TITLE» «FIRST» «MIDDLE» «SURNAME»«EXT»
«V_SCHOOL»
«V_ADD1»
«V_ADD2»
«V_CITY», VA «VA_ZIP»

Dear Principal «SURNAME»:

I am writing to ask your help. As you know from Dr. Neugent's letter, the Virginia General Assembly wants to hear from you and other principals about technology use in schools. The Virginia Department of Education commissioned our consortium—comprised of the Milken Exchange on Education Technology, the North Central Regional Educational Laboratory (NCREL), and SRI International—to survey you and other Virginia school principals. The enclosed survey gives you the opportunity to tell us about the availability of technology in your school and how it is used for instruction. Particular attention will be paid to teachers' competency in using technology, the integration of technology in the core academic subject areas, and student outcomes related to those specified in the Virginia Standards of Learning.

The time required to complete the questionnaire will vary. If you are an elementary school principal, you may be able to complete it in about one hour; if you lead a large high school, you and your staff may need to spend several hours. You have the option of designating someone else in your school, perhaps your lead technology person, to complete all or part of this survey.

To ensure that your school is represented in this study, please complete the questionnaire within the next few days and return it in the enclosed pre-paid Federal Express mailer. You only need to fill out Part 1 of the airbill with your name and the address of your school. You may put the mailer in any FedEx drop box or call FedEx at 1-800-463-3339 for a free pick-up at your school.

Thank you very much for taking the time to read this letter and—in advance—for answering the questionnaire. If you have any questions about the survey, or returning it, please call me toll-free at 1-800-356-2735, extension 1280.

Sincerely,

Shannon Cahill, Ph. D.
Primary Investigator/Project Manager

enclosures

1900 Spring Road, Suite 300 ▪ Oak Brook, Illinois 60523-1480 ▪ 630-571-4700 ▪ Fax: 630-571-4716 ▪ www.ncrel.org

Principal and Teacher surveys

NCREL
North Central Regional Educational Laboratory
"Applying Research and Technology to Learning"

September 16, 1998

«TITLE» «FIRST» «MIDDLE» «SURNAME»«EXT»
«V_SCHOOL»
«V_ADD1»
«V_ADD2»
«V_CITY», VA «VA_ZIP»

Dear Principal «SURNAME»:

I am writing to ask your help. As you know from Dr. Neugent's letter, the Virginia General Assembly wants to hear from you and your teachers about technology use in schools. The Virginia Department of Education commissioned our consortium—comprised of the Milken Exchange on Education Technology, the North Central Regional Educational Laboratory (NCREL), and SRI International—to survey you and other Virginia schools. The enclosed survey gives you the opportunity to tell us about the availability of technology in your school and how it is used for instruction. Particular attention will be paid to teachers' competency in using technology, the integration of technology in the core academic subject areas, and student outcomes related to those specified in the Virginia Standards of Learning.

The time required to complete the questionnaire will vary. If you are an elementary school principal, you may be able to complete it in about one hour; if you lead a large high school, you and your staff may need to spend several hours. You have the option of designating someone else in your school, perhaps your lead technology person, to complete all or part of this survey.

Please use the attached instruction sheet to select a few teachers to take the enclosed teacher surveys. Teachers should be able to complete their survey in about forty-five minutes or less.

To ensure that your school is represented in this study, you and your teachers should complete the questionnaires within the next few days and return all of them together it in the enclosed pre-paid Federal Express mailer. You only need to fill out Part 1 of the airbill with your name and the address of your school. You may put the mailer in any FedEx drop box or call FedEx at 1-800-463-3339 for a free pick-up at your school.

Thank you very much for taking the time to read this letter and—in advance—for answering the questionnaire. If you have any questions about the survey, or returning it, please call me toll-free at 1-800-356-2735, extension 1280.

Sincerely,

Shannon Cahill, Ph. D.
Primary Investigator/Project Manager

enclosures

tchr

1900 Spring Road, Suite 300 ▪ Oak Brook, Illinois 60523-1480 ▪ 630-571-4700 ▪ Fax: 630-571-4716 ▪ www.ncrel.org

NCREL
North Central Regional Educational Laboratory

Teacher cover letter

"Applying Research and Technology to Learning"

September 18, 1998

Dear Colleague;

I am writing to ask your help with assessing educational technology in your school. As you know, the state of Virginia has allocated over $120 million since 1996 for educational technology. These funds have been used for infrastructure, classroom computers, and tools to help educators teach more effectively and students learn more efficiently. To assess the value of this investment, the General Assembly directed the Department of Education to conduct a survey of all Commonwealth schools concerning the availability and use of educational technologies.

The attached survey gives you the opportunity to tell the General Assembly and others about the availability of technology in your school, how it is used for instruction in core academic subjects, and student outcomes related to the Virginia Standards of Learning. Study summaries will be reported to you and the public through the Department of Education's Internet site (www.pen.k12.va.us).

You were randomly selected as one of a few teachers in the study so your answers are very important. I realize that this comes as you are in the process of beginning the school year, but I hope that you will be able to set aside about forty-five minutes within the next few days to complete this important survey. Return your completed survey to your principal who will then return it to me along with a few other surveys from your school.

Thank you very much for taking the time to read this letter and—in advance—for answering the questionnaire. If you have any questions about the survey, please call me toll-free at 1-800-356-2735, extension 1280.

Sincerely,

Shannon Cahill

Shannon Cahill, Ph. D.
Primary Investigator/Project Manager

attachment

1900 Spring Road, Suite 300 ▪ Oak Brook, Illinois 60523-1480 ▪ 630-571-4700 ▪ Fax: 630-571-4716 ▪ www.ncrel.org

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF EDUCATION
P. O. BOX 2120
RICHMOND, VIRGINIA 23218-2120

SUPTS. MEMO. NO.
August 28, 1998

INFORMATIONAL

TO: Division Superintendents

FROM: Paul D. Stapleton
Superintendent of Public Instruction

Subject: ***An Analysis of the Status of Educational Technology Availability and Usage in the Public Schools of Virginia***

The Department of Education has contracted with the Milken Exchange/North Central Regional Educational Laboratory/ Stanford Research Institute Consortium to conduct an analysis of the status of educational technology availability and usage in the public schools of Virginia. The goals of this study include determining the availability of technologies to help students to meet the technology Standards of Learning, the availability and type of technology available for instructional activities on a daily basis, the use of technology within the curriculum, and the training available to classroom teachers.

As part of this study, the consortium will distribute surveys that address the goals of the project to all school principals and to a sampling of teachers representing all schools in Virginia. This representation will include such factors as level of school (elementary, middle, secondary), location (rural, urban, suburban), and discipline (core and other curricular areas). Additionally, visits will be made to schools in each regional study group area to observe use of technology, interview principals and teachers, and review documents to validate survey information.

Should you be contacted by Shannon Cahill, Sarah Shaw, Bill Quinn, and Andrew Zucker, I urge your full cooperation. Your contributions to this study will help ensure that accurate information concerning the status and use of educational technology in Virginia is conveyed to Governor Gilmore, the

General Assembly, and the Board of Education. Questions or requests for additional information should be directed to Lan W. Neugent, Assistant Superintendent for Technology at 804-225-2757.

PDS/LWN/emt

VIRGINIA DEPARTMENT OF EDUCATION:
Schoolwide Survey of Technology Status and Use

Thank you for participating in this survey. The survey was commissioned by the Virginia Department of Education and is being conducted by the Milken Exchange on Education Technology, the North Central Regional Educational Laboratory (NCREL), and SRI International.[1] Please return your completed survey to NCREL in the enclosed Federal Express packet using the prepaid airbill. If you have any questions, call (800) 356-2735, extension 1280.

Again, thank you!

BACKGROUND INFORMATION

Division: ____________________ School: ____________________

Division-School Number: ______–________ 5

Your Name: ____

Your Title: ____

Phone: ( ) ____–______ Fax: ( ) ____–______ E-mail: ____________________

1. In what type of community is your school located? *(check one)*
   ☐ a. Urban ☐ b. Suburban ☐ c. Rural

2. What are the lowest and highest grades taught in your school? *(e.g., Pre-K, K, 6, 9, etc.)*
   ______ a. Lowest grade ______ b. Highest grade

3. How many full-time and part-time classroom teachers are employed in your school?
   ______ a. Full-time teachers ______ b. Part-time teachers

4. **Elementary grade levels only:** How many teachers do you have **at each grade level**? *(Both full-time and part-time teachers count as one.)* 20-21
   - ______ a. Pre-K
   - ______ b. Kindergarten
   - ______ c. First
   - ______ d. Second
   - ______ e. Third
   - ______ f. Fourth
   - ______ g. Fifth
   - ______ h. Sixth
   - ______ i. Seventh
   - ______ j. Ungraded

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[1] Milken Exchange on Education Technology
Milken Family Foundation
1250 Fourth Street, Fourth Floor
Santa Monica, CA 90401-1353

North Central Regional
Educational Laboratory
1900 Spring Road, Suite 300
Oak Brook, IL 60523-1480

SRI International
1611 North Kent Street
Arlington, VA 22209

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5. **Middle and secondary grade levels only:** How many teachers do you have **by subject area**? *(Count full- and part-time teachers only once under the subject they teach most.)*

______ a. History/social science
______ b. Mathematics
______ c. Science
______ d. English
______ e. All other subjects

I. LEARNERS

6. **Schools with 5th grade students:** Based upon your obsevations, how well did your 1997-98 **5th grade** students meet or exceed the Virginia Standards of Learning for Computer/Technology? *(check one)* 50

☐ a. Not well
☐ b. Fairly well
☐ c. Well
☐ d. Extremely well
☐ e. Not sure

7. **Schools with 8th grade students:** Based upon your obsevations, how well did your 1997-98 **8th grade** students meet or exceed the Virginia Standards of Learning for Computer/Technology? *(check one)*

☐ a. Not well
☐ b. Fairly well
☐ c. Well
☐ d. Extremely well
☐ e. Not sure

8. Based upon your observations, how has technology influenced students in the following areas?

1 = Much Declined
2 = Somewhat Declined
3 = No Effect
4 = Somewhat Improved
5 = Much Improved
6 = Not Sure

______ a. Overall level of academic achievement
______ b. Knowledge in mathematics
______ c. Knowledge in science
______ d. Knowledge in history/social science
______ e. Knowledge in English
______ f. Higher-level skills *(e.g., problem solving, constructing knowledge)*
______ g. Fluency in using technology for a variety of educational purposes
______ h. Ability to set their own pace for learning
______ i. Motivation to learn, going beyond minimal assignments

9. Based upon your observations, what influence has the integration of technology in learning had on students in the following areas.

1 = Much Decreased
2 = Somewhat Decreased
3 = No Effect
4 = Somewhat Increased
5 = Much Increased
6 = Not Sure

______ a. School attendance 61
______ b. Interest in school
______ c. Dropout rate
______ d. Communicating and sharing ideas with others outside their school
______ e. Number of behavior referrals
______ f. Amount of choice students have in selecting projects/assignments for study
______ g. The number of roles students assume in learning *(e.g., trainer, publisher)*

10. For the last three years, what has been the most noticeable change in academic achievement in your school, if any, that may be related to increased use of technology? What specific evidence *(e.g., student portfolios, projects, test scores, observation, etc.)* have you seen relating to this change?

____

____

____

____

II. LEARNING ENVIRONMENTS

11. Overall, how well is technology integrated into learning in your school? *(check one)*

☐ a. Not well ☐ c. Well ☐ e. Not sure 68
☐ b. Fairly well ☐ d. Extremely well

12. Based upon your observations, estimate how much time per week a typical **student** spends in school on the following?

1 = Little or no time *3 = 15 to 30 min.* *5 = Over 60 min.*
2 = Less than 15 min. *4 = 30 to 60 min.* *6 = Not Sure*

______ a. Using computers for any educational purpose
______ b. Viewing videotapes or television in a non-interactive environment
______ c. Participating in an interactive video environment *(e.g., for distance learning)*
______ d. Using graphing and/or scientific calculators
______ e. Using technology peripherals for educational purposes *(e.g., scanners, printers)*
______ f. Working with lasers, robotics, remote sensors, etc.

13. Based upon your observations, estimate how much time per week typical members of the **school staff** spend using computers and similiar technologies for their work?

1 = Little or no time *3 = 15 to 30 min.* *5 = Over 60 min.*
2 = Less than 15 min. *4 = 30 to 60 min.* *6 = Not Sure*

______ a. Teachers
______ b. Building administrators and counselors
______ c. Support personnel
______ d. Library media specialists

14. Based upon your observations, estimate the percentage of your **teaching staff** who use educational technology to do each of the following activities? 2/5-7

______% a. Instruct students
______% b. Communicate with parents or with colleagues inside or outside the school
______% c. Check or record student information
______% d. Prepare for instruction

15. Based upon your observations, what influence has technology had on your school as a whole in the following areas?

1 = Much Declined
2 = Somewhat Declined
3 = No Effect
4 = Somewhat Improved
5 = Much Improved
6 = Not Sure

______ a. General staff morale
______ b. Educators' sense of empowerment to address school issues
______ c. Ability to work in teams to identify goals, make decisions, solve problems
______ d. Ability/willingness to share ideas and skills with others
______ e. Efficiency or effectiveness of school management
______ f. Relationship with parents and the community

III. PROFESSIONAL COMPETENCY

16. In general, how well do you think teacher preparation institutions are training teachers to use technology in instruction? *(check one)* 23

☐ a. Not well
☐ b. Fairly well
☐ c. Well
☐ d. Extremely well
☐ e. Not sure

17. Based upon your observations, approximately what proportion of your teachers meet or exceed the Virginia Technology Standards for Instructional Personnel? *(check one)*

☐ a. Under 10%
☐ b. 10-25%
☐ c. 25-50%
☐ d. 50-75%
☐ e. 75-100%
☐ f. Not sure

18. **Elementary grade levels only:** At which grade levels in your school, if any, are a majority of teachers **proficient** on the Virginia Technology Standards for Instructional Personnel? *(check all that apply)*

☐ a. Pre-K
☐ b. Kindergarten
☐ c. First
☐ d. Second
☐ e. Third
☐ f. Fourth
☐ g. Fifth
☐ h. Sixth
☐ i. Seventh
☐ j. Ungraded

19. **Middle and secondary grade levels only:** In which subjects, if any, are a majority of teachers **proficient** on the Virginia Technology Standards for Instructional Personnel? *(check all that apply)*

☐ a. History/Social Sciences
☐ b. Mathematics
☐ c. Science
☐ d. English
☐ e. Other (specify): ______________________________ 39

20. Briefly describe any strategy or instrument that your division or school uses for assessing the level of staff competence on the Virginia Technology Standards for Instructional Personnel.

☐ Check here if you have no strategy at this time

____
____
____
____
____

21. How much emphasis was given in the last school year to technology training in your school in the following areas? 41

1 = No Training on This Topic
2 = Little Emphasis
3 = Moderate Emphasis
4 = Substantial Emphasis
5 = Not Sure

______ a. Basic computer operations (including Internet applications)
______ b. Using technology to create unique learning opportunities for students
______ c. Using technology to participate in professional networks and to advance their own practice
______ d. Using technology to create educational contexts in which students take a more independent role in their own learning

IV. SYSTEM CAPACITY

22. Do you think that your state government is spending too much money, too little money, or about the right amount of money on computers for instructional purposes? *(check one)*

☐ a. Too much money
☐ b. Too little money
☐ c. The right amount of money
☐ d. Not sure

23. To what degree will the Virginia Department of Education funds, along with existing school and division resources, provide adequate funding to allow your school to implement your technology goals?

☐ a. Not well
☐ b. Fairly well
☐ c. Well
☐ d. Extremely well
☐ e. Not sure

24. Identify your **top three** priorities from the list below for added technology funding. Write "1" by the area needing the largest increase in funding, "2" by the next largest increase, and "3" by the third largest increase.

______ a. Planning and program development for technology use 47
______ b. Preparing the building for technology *(e.g., power, ventilation, security)*
______ c. Upgrading the building's infrastructure *(e.g., wiring classrooms, installing networks)*
______ d. Purchasing hardware *(e.g., computers, video cameras, etc.)*
______ e. Purchasing software and related course material *(e.g., CD-ROMs, videos, online services)*
______ f. Budgeting for telecommunications services *(e.g., Internet service providers, phone lines)*
______ g. Training teachers and technology support staff to operate the technology
______ h. Providing professional development for the effective use of technology
______ i. Hiring technology support staff
______ j. Purchasing supplies *(e.g., diskettes, paper, toner)*
______ k. Budgeting for hardware and software replacements and upgrades

25. Does the division or school provide any of the following incentives to encourage teachers to use technology to enhance learning? *(check all that apply)*

☐ a. Release time for planning the use of technology 50
☐ b. Technology-related resources approved for media center and classroom purchases
☐ c. Expectation/requirement that professional staff use technology as a research and learning tool
☐ d. Use of school technology over the summer months
☐ e. Special purchasing programs for computers/technology
☐ f. Funding for classroom-based and media center technology resources
☐ g. Access to a technology-based administrative system for efficiencies
☐ h. Technology certification for teachers who are trained in technology
☐ i. Salary incentives for teachers seeking technology training
☐ j. Acknowledgment of effective teacher use of technology
☐ k. Schedule changes so teachers have time to learn and plan collaboratively

26. Does your school have a formal, written **school-level** technology plan? *(check one)*

☐ a. Yes ☐ b. No ☐ c. Not sure

27. Does your school have a **written** policy regarding appropriate technology use **by students**?

☐ a. Yes ☐ b. No ☐ c. Not sure

28. Does your school have a **written** policy regarding appropriate technology use **by teachers**? 64

☐ a. Yes ☐ b. No ☐ c. Not sure

29. What types of technology training and support are available in your school? Circle "Y" or "N" to indicate whether training is available and whether teachers have used it. If used, rate how effective you think it was.

			How effective was it? *(check one)*				
Type of Training and Support	**Available Yes/No**	**Used Yes/No**	Not Effective	Somewhat Effective	Effective	Very Effective	Not Sure
a. Informal, self-taught, need-driven, and as time allows	Y N	Y N					
b. Formal workshops/seminars that are lead by experts with a focus on a topic or skill	Y N	Y N					
c. Development of collaborative teams of teachers and others who solve problems, make decisions, and prepare lessons	Y N	Y N					
d. Help-desk technical support provided by the division, in-school specialists, or others	Y N	Y N					
e. Regional consortiums	Y N	Y N					
f. Virginia State Department of Education	Y N	Y N					
g. Telecommunications (e.g., distance learning)	Y N	Y N					

3/5

V. COMMUNITY CONNECTIONS

30. How extensive a role did your community play in shaping your school's vision for technology? 14

☐ a. None
☐ b. Minor role
☐ c. Moderate role
☐ d. Major role
☐ e. Not sure

31. How involved are the following groups in promoting or enhancing the use of technology in your school? Involvement may include donating money, time, or resources.

1 = Not Involved
2 = Slightly Involved
3 = Moderately Involved
4 = Very Involved
5 = Not Sure

______ a. Parent, teacher, or student organizations
______ b. Business groups
______ c. Local post-secondary institutions
______ d. Other (please specify): ______________________________

32. To what extent does your school offer the community technology-based resources and services *(e.g., access to computer labs, instruction in how to use computers, student research projects that benefit the community)*?

☐ a. Very little
☐ b. A little
☐ c. Somewhat
☐ d. A great deal
☐ e. Not sure

VI. TECHNOLOGY CAPACITY

33. Compared with other educational priorities, how important is it to provide public schools with access to computers? *(check one)* 20

☐ a. One of the top priorities
☐ b. Near the top of the list of priorities
☐ c. In the middle of the list of priorities
☐ d. Toward the bottom of the list of priorities
☐ e. Not sure

34. What is the lowest, highest, and average number of computers in each classroom?

______ a. Lowest
______ b. Highest
______ c. Average

35. Is there someone in your school who has **at least** 20% FTE (about 8 hours per week) assigned to supporting teachers' use of instructional technology?

☐ a. Yes
☐ b. No

36. Which of the following items are available for instructional use in your school? *(check all that apply)*

☐ a. Color or laser printers
☐ b. Optical laser lab equipment
☐ c. Scanners/digitizers
☐ d. Digital probes, sensors
☐ e. Digital cameras
☐ f. Graphing calculators
☐ g. Video cameras, editing suites
☐ h. Robotics equipment

37. What percentage of classrooms in your school is equipped with the following technologies? 36-38

_____% a. Phones

_____% b. Computers connected to the Internet

_____% c. TV monitors and cable or antenna feeds

38. What percentage of other instruction rooms *(e.g., media center, special ed. room)* is equipped with these technologies?

______% a. Phones

______% b. Computers connected to the Internet

______% c. TV monitors and cable or antenna feeds

39. What capability does your school have for receiving and/or transmitting live or delayed instruction from a distance? *(check all that apply)*

☐ a. One-way video and audio *(e.g., cable TV, satellite dish, microwave link)*

☐ b. One-way video, two-way audio *(e.g., TV broadcast, live phone call from distant to central site)*

☐ c. Two-way audio and video *(e.g., video conference link between two sites)*

☐ d. Internet-based distance learning

☐ e. We do not use distance learning in our school

40. Overall, how would you rate the suitability of your school building for using instructional technology *(e.g., space for computers, ease of wiring, lighting, ventilation, security)*?

☐ a. Not at all suitable

☐ b. Somewhat suitable

☐ c. Suitable

☐ d. Very suitable

☐ e. Not sure

41. Please indicate below the number of computers in your school used by teachers and students for instruction and learning. Also list computers used only for administrative or counseling purposes. **Do not include** computers in storage and/or in disrepair.

	Total Number of Workstations by Location			
	Computer Lab	**All Classrooms**	**Media Center/ Other Sites**	**Admin. and Counseling**
a. PC—486 or better				
b. PC—less than a 486				
c. Mac—LCIII or better				
d. Apple II, IIe, and Mac less than an LCIII				
e. Monitors and keyboards only linked to a mainframe computer				
Of the total computers/terminals listed above, how many are...				
f. Multimedia enhanced (CD-ROM, sound, extra memory)				
g. Connected to a local area network (LAN)				
h. Connected through modem to the Internet or other external networks				
i. Connected through a high speed network *(e.g., ISDN, SMDS, ATM, fiber)* to the Internet or other external networks				

64

5/5-16

42. Which of the following support services are available in your school? *(check all that apply)* 29

	Hardware	Network	Software
a. Division-level support specialist	☐	☐	☐
b. School-level support specialist	☐	☐	☐
c. Technical help-desk	☐	☐	☐
d. Online e-mail or Web-based support	☐	☐	☐
e. Online end-user training	☐	☐	☐

VII. ACCOUNTABILITY

43. Which type of information, if any, does your school or division report to the local school board or the community about the educational use of technology? *(check all that apply)*

☐ a. Basic information on computer facilities and capacity
☐ b. School technology program innovations, progress, and problems
☐ c. Student outcomes associated with the use of technology
☐ d. Cost benefits of technology use for education
☐ e. Other (please specify): ______________________________

44. To what extent does this reporting process provide feedback which can be incorporate into your school's technology plan? 49

☐ a. Very little
☐ b. A little
☐ c. Somewhat
☐ d. A great deal
☐ e. Not sure

45. To what extent do you consider the following factors as barriers to increased use of educational technologies in your school?

1 = Significant Barrier
2 = Moderate Barrier
3 = Minor Barrier
4 = Not a Barrier
5 = Not Sure

______ a. Cost of purchasing computer hardware
______ b. Cost of making building changes to accommodate technology *(e.g. air conditioning, power)*
______ c. Cost of technical support for the training of teachers/staff
______ d. Cost of ongoing system support *(e.g., maintenance, repair)*
______ e. Cost of computer and software upgrades, aging equipment
______ f. Out-of-date telephone service to our school building
______ g. Lack of textbooks that integrate the use of technology
______ h. Difficulty in finding computer software to match instructional needs
______ i. Lack of time for training teachers to use computers/educational technology
______ j. Lack of computer skills/expertise among teachers
______ k. Lack of computer skills/expertise among students
______ l. Lack of teacher support or interest
______ m. Lack of administrative/school board support
______ n. Lack of community support *(e.g., businesses, foundations)*
______ o. Other (specify): ______________________________ 64

Please use the space below for any additional comments you would like to share with us regarding the use of technology in your school.

Thank You.

VIRGINIA DEPARTMENT OF EDUCATION:
Schoolwide Survey of Technology Status and Use
Teacher Survey

Thank you for participating in this survey. The survey was commissioned by the Virginia Department of Education and is being conducted by the Milken Exchange on Education Technology, the North Central Regional Educational Laboratory (NCREL), and SRI International.[1] Please give your completed survey to your principal, who will return all surveys from your school to NCREL. If you have any questions, please call (800) 356-2735, extension 1280.

Again, thank you!

BACKGROUND INFORMATION

Division: ____________________ School: ____________________ 5

Division-School Number: ________–__________

Optional

Your Name: ______________________________

Your Title: ______________________________

Phone: ( ) ___–_____ Fax: ( ) ___–_____ E-mail: ____________________

1. What grade(s) do you currently teach? *(check all that apply)*
   - ☐ a. Pre-K
   - ☐ b. Kindergarten
   - ☐ c. 1st grade
   - ☐ d. 2nd grade
   - ☐ e. 3rd grade
   - ☐ f. 4th grade
   - ☐ g. 5th grade
   - ☐ h. 6th grade
   - ☐ i. 7th grade
   - ☐ j. 8th grade
   - ☐ k. 9th grade
   - ☐ l. 10th grade
   - ☐ m. 11th grade
   - ☐ n. 12th grade
   - ☐ o. Ungraded

2. **For elementary school teachers:** How many students are in your classroom? If you teach more than one class, what is the average number of students per class?

   _____ Students 27-28

3. **For middle and secondary school teachers:** What is the average number of students in your class(es)?

   _____ Students

4. **Middle and secondary school teachers:** Which subject(s) do you teach? *(check all that apply)*
   - ☐ a. History/social science
   - ☐ b. Mathematics
   - ☐ c. Science
   - ☐ d. English
   - ☐ e. Some other subject(s)

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1611 North Kent Street
Arlington, VA 22209

5. **Middle and secondary school teachers:** Which subject do you teach **most**? *(check one)* 36

☐ a. History/social science
☐ b. Mathematics
☐ c. Science
☐ d. English
☐ e. Some other subject(s)

6. By the end of this school year, how many years will you have been teaching?

______ Total years teaching

7. Is there a personal computer in your household? *(check one)*

☐ a. Computer with modem *(please go to question 8)*
☐ b. Computer, but no modem *(skip to question 9)*
☐ c. No computer at home *(skip to question 9)*

8. How often do you use the Internet or other online computer services at home? *(check one)*

☐ a. Daily or almost daily
☐ b. One or more times per week
☐ c. One or more times per month
☐ d. Less than monthly
☐ e. Never

I. LEARNERS

9. **If you teach fifth-grade students:** Based on your observations, roughly what proportion of your 1997-98 **fifth-grade** students meets or exceeds the Virginia Standards of Learning for Computer/Technology? *(check one)* 41

☐ a. 0% to 25%
☐ b. 25% to 50%
☐ c. 50% to 75%
☐ d. 75% to 100%
☐ e. Not sure

10. **If you teach eighth-grade students:** Based on your observations, roughly what proportion of your 1997-98 **eighth-grade** students meets or exceeds the Virginia Standards of Learning for Computer/Technology? *(check one)*

☐ a. 0% to 25%
☐ b. 25% to 50%
☐ c. 50% to 75%
☐ d. 75% to 100%
☐ e. Not sure

11. Based on your observations, how has technology influenced students in the following areas?

1 = Much Declined
2 = Somewhat Declined
3 = No Effect
4 = Somewhat Improved
5 = Much Improved
6 = Not Sure

______ a. Overall level of academic achievement 43
______ b. Knowledge in mathematics
______ c. Knowledge in science
______ d. Knowledge in history/social science
______ e. Knowledge in English
______ f. Understanding of "the basics" in the subject(s) you teach
______ g. Higher-level skills *(e.g., problem solving, constructing knowledge)*
______ h. Fluency in using technology for a variety of educational purposes
______ i. Ability to set their own pace for learning
______ j. Motivation to learn, going beyond minimal assignments

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12. Based on your observations, what influence has the integration of technology in learning had on students in the following areas?

1 = Much Decreased	*3 = No Effect*	*5 = Much Increased*
2 = Somewhat Decreased	*4 = Somewhat Increased*	*6 = Not Sure*

______ a. School attendance in general 53
______ b. School attendance on days when technology is scheduled to be used
______ c. Interest in school
______ d. Communicating and sharing ideas with others outside the school
______ e. Number of behavior referrals
______ f. Amount of choice students have in selecting projects/assignments for study
______ g. Number of roles students assume in learning *(e.g., trainer, publisher)*
______ h. Number of assignments students turn in that were produced with technology *(e.g., word processing, e-mail, spreadsheets)*
______ i. Student engagement in inquiry-based learning projects
______ j. The amount of schoolwork students do at home
______ k. Students' independence as learners
______ l. Students' attentiveness/engagement in class
______ m. Student engagement in project-based activities
______ n. Amount of time students spend working with other students in their class/school
______ o. The *breadth* of students' understanding of the subject(s) you teach
______ p. The *depth* of students' understanding of the subject(s) you teach 68

13. For the last three years, what has been the most noticeable change in academic achievement in your school, if any, that may be related to increased use of technology? What specific evidence *(e.g., student portfolios, projects, test scores, observation, etc.)* have you seen relating to this change?

14. What academic outcomes do you most expect to see in the future based upon the way you are now using technology for learning?

II. LEARNING ENVIRONMENTS

15. Overall, how well is technology integrated into learning in your **school**? *(check one)* 2/5

☐ a. Not well	☐ c. Well	☐ e. Not sure
☐ b. Fairly well	☐ d. Extremely well	

16. Overall, how well is technology integrated into learning in your classroom/courses? *(check one)* 6

☐ a. Not well
☐ b. Fairly well
☐ c. Well
☐ d. Extremely well
☐ e. Not sure

17. On average, how much time per **week** does a **typical** student spend in your classroom on the following?

1 = Little or no time
2 = Less than 15 min.
3 = 15 to 30 min.
4 = 30 to 60 min.
5 = Over 60 min.
6 = Not Sure

______ a. Using computers for any educational purpose
______ b. Viewing videotapes or television in a non-interactive environment
______ c. Participating in an interactive video environment *(e.g., for distance learning)*
______ d. Using graphing and/or scientific calculators
______ e. Using technology peripherals for educational purposes *(e.g., scanners, printers)*
______ f. Using computer simulations
______ g. Word processing
______ h. Managing databases
______ i. Managing/analyzing spreadsheets
______ j. Researching information on CD-ROM
______ k. Researching information on the Internet
______ l. Developing Web pages
______ m. Using desktop publishing and/or graphics programs
______ n. Working with lasers, robotics, digital sensors, etc.
______ o. Using content-specific programs for purposes of drill and practice
______ p. Other (specify): ______________________________

18. On average, how much time per **week** do **you** spend using technology for your work?

1 = Little or no time
2 = Less than 15 min.
3 = 15 to 30 min.
4 = 30 to 60 min.
5 = Over 60 min.
6 = Not Sure

______ a. Basic computer operations (including Internet applications) 23
______ b. Communicating with colleagues inside and outside the school/division
______ c. Checking or reporting on student information
______ d. Conducting research that contributes to lesson plans and curriculum design
______ e. Word processing
______ f. Managing/analyzing spreadsheets
______ g. Researching information on CD-ROM
______ h. Researching information on the Internet
______ i. Developing Web pages
______ j. Using desktop publishing and/or graphics programs
______ k. Developing instructional presentations
______ l. Working with lasers, robotics, remote sensors, etc.
______ m. Using e-mail to communicate with parents
______ n. Using the Internet to provide the community information about your classroom or school
______ o. Other (specify): ______________________________

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19. Approximately what percentage of your **use** of educational technologies is for each of the following activities? 38-39

______% a. Instruct students

______% b. Communicate with parents or colleagues inside or outside the school

______% c. Check or record student information

______% d. Prepare for instruction

20. To what extent do you emphasize the use of technology in the following subjects?

1 = Not at all
2 = A little
3 = Somewhat
4 = A lot
5 = I don't teach this subject

______ a. History/social science

______ b. Mathematics

______ c. Science

______ d. English

______ e. Other (specify): ____

21. What influence has technology had on **you** in the following areas?

1 = Much Declined
2 = Somewhat Declined
3 = No Effect
4 = Somewhat Improved
5 = Much Improved
6 = Not Sure

______ a. General morale 51

______ b. Sense of empowerment to address school issues

______ c. Ability to work in teams to identify instructional goals, make decisions, and solve problems

______ d. Ability/willingness to share ideas and skills with others

______ e. Efficiency or effectiveness of classroom management

______ f. Relationship with parents and the community

______ g. The overall quality of instruction you deliver

22. What influence has the integration of technology in learning had on the following?

1 = Much Decreased
2 = Somewhat Decreased
3 = No Effect
4 = Somewhat Increased
5 = Much Increased
6 = Not Sure

______ a. Your repertoire of instructional strategies 58

______ b. The amount of materials and resources you use in your class(es)

______ c. The number of changes you've made in the curriculum

______ d. Your participation in instructional planning at the department or school level

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III. PROFESSIONAL COMPETENCY

23. **In general, how well do you think teacher preparation institutions are training teachers to use technology in instruction?** ***(check one)*** 62

☐ a. Not well ☐ c. Well ☐ e. Not sure
☐ b. Fairly well ☐ d. Extremely well

24. **Overall, how would you rate your own level of preparation for using technology in instruction?**

☐ a. Not prepared ☐ c. Moderately prepared ☐ e. Very well prepared
☐ b. Poorly prepared ☐ d. Well prepared

25. **Please rate how much your school emphasized the following types of technology training during the 1997-98 school year. Then put a check showing your skill level for each area.** 64-65

	Amount of Emphasis 1 = Very Little 4 = Very Much				Your Skill Level			
					Beginner	Intermed	Advanced	Not Sure
a. Basic computer operations (including Internet applications)	1	2	3	4				
b. Using technology to create unique learning opportunities for students	1	2	3	4				
c. Using technology to participate in professional networks and advance your own practice	1	2	3	4				
d. Using technology to create educational contexts in which students take on a more independent role in their learning	1	2	3	4				
e. Advanced telecommunications, such as creating a Web page or setting up distance learning opportunities	1	2	3	4				
f. Curriculum and instructional applications of technology use	1	2	3	4				

IV. SYSTEM CAPACITY

26. **Do you think your state government is spending too much money, too little money, or about the right amount of money on computers for instructional purposes?** ***(check one)*** 3/5

☐ a. Too much money ☐ c. The right amount of money
☐ b. Too little money ☐ d. Not sure

27. What types of technology training and support are available in your school? Circle "Y" or "N" to indicate whether training is available and whether you have used it. If used, rate how effective you think it was.

Type of Training and Support	Available Yes/No	Used Yes/No	How effective was it? *(check one)*				
			Not Effective	Somewhat Effective	Effective	Very Effective	Not Sure
a. Informal, self-taught, and as time allows	Y N	Y N					
b. Formal workshops/seminars that are lead by experts with a focus on topic or skill	Y N	Y N					
c. Development of collaborative teams of teachers and others who solve problems, make decisions, prepare lessons	Y N	Y N					
d. Help-desk technical support provided by the division, in-school specialists, or others	Y N	Y N					
e. Regional consortiums	Y N	Y N					
f. Virginia State Department of Education	Y N	Y N					
g. Telecommunications *(e.g., distance learning)*	Y N	Y N					

6-8

28. Does the division or school provide any of the following incentives to encourage teachers to use technology to enhance learning? *(check all that apply)*

☐ a. Release time for planning the use of technology 27
☐ b. Technology-related resources approved for media center and classroom purchases
☐ c. Expectation/requirement that professional staff use technology as a research and learning tool
☐ d. Use of school technology over the summer months
☐ e. Special purchasing programs for computers/technology
☐ f. Funding for classroom-based and media center technology resources
☐ g. Access to a technology-based student record system
☐ h. Technology certification for teachers who are trained in technology
☐ i. Salary incentives for teachers seeking technology training
☐ j. Acknowledgement of effective teacher use of technology
☐ k. Schedule changes so teachers have time to learn and plan collaboratively

V. COMMUNITY CONNECTIONS

29. How involved are the following groups in promoting or enhancing the use of technology in your school? Involvement may include donating money, time, or resources.

1 = Not Involved *3 = Moderately Involved* *5 = Not Sure*
2 = Slightly Involved *4 = Very Involve*

_____ a. Parent, teacher, or student organizations 38
_____ b. Business groups
_____ c. Local post-secondary institutions
_____ d. Other (specify): ____

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30. To what extent does your school offer to the community technology-based resources and services *(e.g., access to computer labs, instruction in how to use computers, student research projects that benefit the community)? (check one)* 42

☐ a. Very little
☐ b. A little
☐ c. Somewhat
☐ d. A great deal
☐ e. Not sure

VI. TECHNOLOGY CAPACITY

31. Compared with other educational priorities, how important is it to provide public schools with access to computers? *(check one)*

☐ a. One of the top priorities
☐ b. Near the top of the list of priorities
☐ c. In the middle of the list of priorities
☐ d. Toward the bottom of the list of priorities
☐ e. Not sure

32. How many computers do you have in your classroom? Of these, how many are connected to the Internet or some other computer network? *(If you teach in several rooms, give the average number of computers across these rooms.)*

______ a. Total number of computers in classroom 44-45
______ b. Number connected to the Internet or another computer network

33. Which of the following is available to you for instructional use in your school? *(check all that apply)*

☐ a. Telephone in your classroom
☐ b. Color or laser printers
☐ c. Optical laser lab equipment
☐ d. Scanners/digitizers
☐ e. Digital probes, sensors
☐ f. TV and cable/antenna feed in your classroom
☐ g. Digital cameras
☐ h. Graphing calculators
☐ i. Video cameras, editing suites
☐ j. Robotics equipment

34. Do you have a computer in your classroom or office at school that has been designated specifically for your use? *(check one)* 58

☐ a. Yes
☐ b. No

35. Please circle the number for your current level of access to the technology resources listed below. Then rate how much access you feel you would need to be most effective in your instruction.

1 = No access 2 = Very little access 3 = Moderate access 4 = Extensive access 5 = Not sure

	Current Access					**Desired Access**					
a. PC—486 or better	1	2	3	4	5	1	2	3	4	5	59-60
b. PC—less than a 486	1	2	3	4	5	1	2	3	4	5	
c. Mac—LCIII or better	1	2	3	4	5	1	2	3	4	5	
d. Apple II, IIe, and Mac less than an LCIII	1	2	3	4	5	1	2	3	4	5	
e. Monitors and keyboards only linked to a mainframe computer	1	2	3	4	5	1	2	3	4	5	
f. Multimedia enhanced computers(CD-ROM, sound, extra memory)	1	2	3	4	5	1	2	3	4	5	
g. Computers connected to a local area network (LAN)	1	2	3	4	5	1	2	3	4	5	
h. Computers connected through modem to the Internet or other external networks	1	2	3	4	5	1	2	3	4	5	
i. Computers connected through a high-speed network *(e.g., ISDN, SMDS, ATM, fiber)* to the Internet or other external networks	1	2	3	4	5	1	2	3	4	5	
j. Computer printers	1	2	3	4	5	1	2	3	4	5	
k. Digital scanners	1	2	3	4	5	1	2	3	4	5	4/5-4/6
l. Video equipment for in-class use only (cameras, TVs, VCRs)	1	2	3	4	5	1	2	3	4	5	
m. Video equipment for distance learning use (cameras, TVs, VCRs)	1	2	3	4	5	1	2	3	4	5	
n. Graphing and/or scientific calculators	1	2	3	4	5	1	2	3	4	5	

36. How well defined is your school's procedure for accessing technology that is in the library, media center, or labs? *(check one)*

☐ a. Don't have a procedure
☐ b. Poorly defined
☐ c. Moderately well defined
☐ d. Very well defined
☐ e. Not sure

37. In general, how easy is it to access the technology you need in your school? *(check one)*

☐ a. Very difficult
☐ b. Difficult
☐ c. Easy
☐ d. Very easy

38. When technology in your classroom breaks down *(e.g., printer jams, can't connect to the Internet)* how long does it typically take to fix the problem? *(check one)* 15

☐ a. Less than 1 hour
☐ b. Less than 1 day
☐ c. 1-2 days
☐ d. 3-4 days
☐ e. More than 5 days
☐ f. Not sure

VII. ACCOUNTABILITY

39. As part of your regular reporting to parents, do you include the following? *(check all that apply)* 16

☐ a. Class goals for technology use
☐ b. Description of the role(s) technology plays in your class(es)
☐ c. Information about students' progress in using technology
☐ d. Descriptions of class projects/activities that involve the use of technology
☐ e. Examples of student work that involves the use of technology
☐ f. Other (specify): ______________________________

40. To what extent do you consider the following factors as barriers to increased use of educational technologies in your school?

1 = Significant Barrier
2 = Moderate Barrier
3 = Minor Barrier
4 = Not a Barrier
5 = Not Sure

______ a. Cost of purchasing computer hardware 22
______ b. Cost of making structural changes to accommodate technology *(e.g., air conditioning, power)*
______ c. Cost of technical support for the training of teachers/staff
______ d. Cost of ongoing system support *(e.g., maintenance, repair)*
______ e. Cost of computer and software upgrades, aging equipment
______ f. Out-of-date telephone service to our school building
______ g. Lack of textbooks that integrate the use of technology
______ h. Difficulty in finding computer software to match instructional needs
______ i. Lack of time for training teachers to use computers/educational technology
______ j. Lack of time to prepare materials and implement technology
______ k. Lack of computer skills/expertise among teachers
______ l. Lack of computer skills/expertise among students
______ m. Lack of teacher support or interest
______ n. Lack of administrative/school board support
______ o. Lack of community support *(e.g., businesses, foundations)*
______ p. Lack of equipment for assisting students with special needs *(e.g., physical disabilities)*
______ q. Too few computers per teacher
______ r. Too few computers per student
______ s. Other (please specify): ______________________________ 40

Please use the space below for any additional comments you would like to share with us regarding the use of technology in your school.

Thank You.